The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. XLIV. No. 1 | APRIL, 1922 | $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3.

Eng.

The Automotive Manufacturer

A Consolidation of The Hub and Automotive Engineering

Vol. XLIV NEW YORK, APRIL, 1922 No. 1

Trucks Save Lumber Firm Time and Money

Experience of Wisconsin Firm on Hard Heavy Work Indicates that Motor Vehicles Are a Good Investment for Wholesale and Retail Lumber Firms.

MANY a firm hesitates to install the modern method of haulage partly because they have never been convinced of its economy, partly because of that age-old (and usually wrong) theory that "our business is different," and at times because of an aversion to new ways. But in recent years, it generally happens that when a firm which has been a long, long time deciding to give motor trucks a real trial, gets around to it, they find that the truck goes farther, much farther in a business sense than they had any idea.

This is well exemplified in the case of the D. J. Rohrer Lumber Co., Clintonville, Wis. This firm, which is well and widely known in that section of northwestern Wisconsin, is a dealer in, and to a certain extent a manufacturer of lumber, building material and interior finish. It handles practically everything from the largest logs to the smallest of finished boards. It had never used trucks until very recently, believing that horses were better in every way. But recently, the change was made to trucks, and the benefits have been much greater, more valuable, in fact more desirable in every business way than they would have believed without actual personal experience.

The story can be told best, perhaps by the manager of the company, in his own words. C. R. Kant has furnished the accompanying picture of the truck and trailers, also the detailed figures. In this latter, it will be noted that a cost of only 4.6 cents a ton-mile has been attained, which is remarkably low. This extremely favorable figure was obtained, too, with only partial operation, as the table shows only 13 days' operation in the month of December. which is a long month. This use of the truck and its trailers but half of the month would be very expensive ordinarily, but the trailers make a tremendous difference, besides which it will be noted that heavy loads were carried so the ton mileage was increased considerably in that way. which also helps to cut down the average cost.

Appearance of the Rohrer truck and trailers coming through the woods in winter snow with a load of huge logs. Note the narrow road.

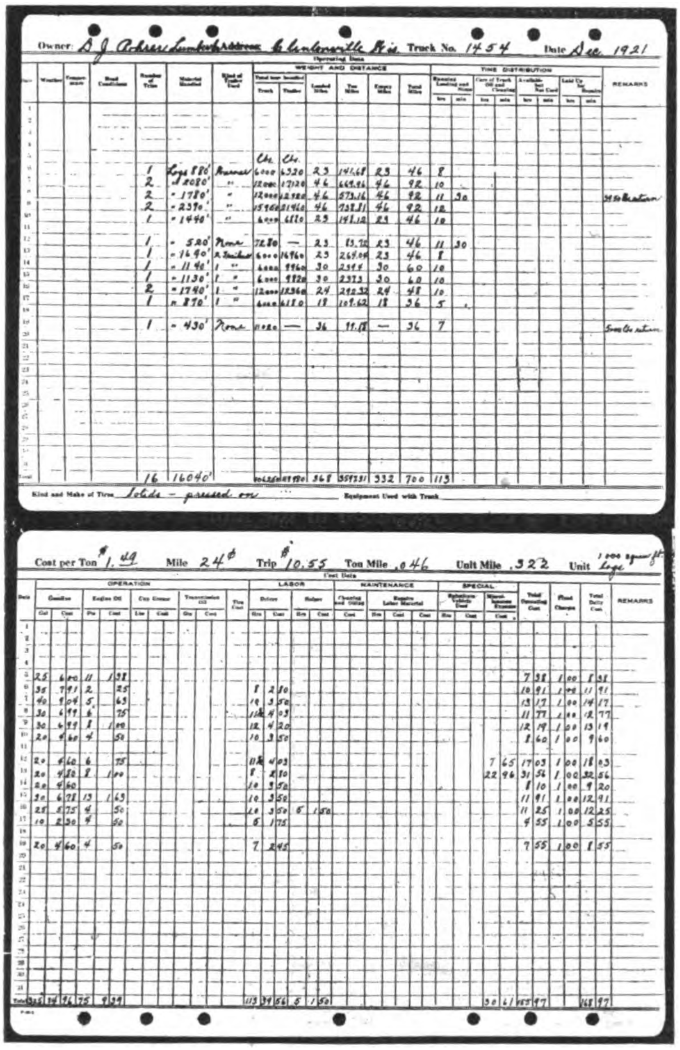
In his own words, Mr. Kant says: "When we began to haul with trucks we used a light truck only. All of our heavier work was done with teams as we believed the motor truck incapable of handling our heavier hauling in as efficient and economical manner, but we gradually became convinced that not only our light hauling but most of our heavy hauling too, could be done with motor trucks, and where time was an important factor, teams could not compare with trucks.

"Early last summer we purchased a used 3-ton FWD truck and a 5-ton trailer from the Four Wheel Drive Auto Company of Clintonville, Wis., and, since, have been using

it for all kinds of hauling. In all of our work we have found it to be an invaluable aid.

"Operation cost records are something comparatively new with us. It was not until some time after the purchase of our heavy truck that we began to keep a definite record of our hauling costs, but we can now safely say that our transportation, including fuel, oil, drivers' wages, depreciation, repairs, insurance, interest on the initial investment and all miscellaneous expense, is costing us far less per ton-mile than was the case when we used teams. In addition to this lower cost we are also able to get better and faster service than ever before.

"In the early part of December, 1921, we sold some red oak veneer logs to the American Plywood Co. of New


Truck No. 1454 Date Dec. 1921
Cost per Ton $1.49 Mile 24¢ Trip $10.55 Ton Mile .046 Unit Mile .322

Record of the Rohrer truck in December, 1921, showing days worked, loads hauled, mileage covered, exact expense, and other items, also deductions from the costs. Above front of sheet, below reverse side.

London, Wis., for immediate delivery which had to be hauled a distance of from 23 to 30 miles. It was a little late in the season and we were expecting heavy snows to come most any time to hinder our hauling, so we went at the job with truck and trailers and made as quick work of it as possible. The weather during the 12 days required to complete this job was not altogether favorable; intermittent rains and snows kept the roads in bad shape for several days. Much to our satisfaction, on these days, we continued to carry the usual loads without difficulty and in some cases carried overloads. For the good work that our FWD truck did on these days we believe that it deserves special mention, for it responded to every emergency and took the long slippery grades without bucking once. In this we were very fortunate, as we finished our hauling none too soon to avoid heavy snows and severe winter weather.

"During the time which it took to complete this hauling job we kept a record of the costs, as shown in the accompanying photograph of the form which we are keeping for our files. One side of the sheet is used for cost data and one for operating data. This data shows in several cases where the truck and trailer were both heavily overloaded and, while we feel that the harm done by overloading is greater than the profits returned from it, were were almost obliged to overload our equipment in this case so as to finish the job before winter weather made our hauling difficult. As a result of our being able to complete this haul in such a short time, we received a premium of $10 per thousand feet. This amounted to a total of $160, which was additional profit, and could not have been earned with teams.

"By operating trucks instead of teams this company now enjoys many of the motor truck's time and money saving advantages, of which the premium collected on the logs hauled to New London is an example.

"It is possible for us now to purchase and haul lumber for our retail yard direct from wholesalers anywhere within a radius of 50 miles. This has its many good features—it saves us the delays common to freight shipments, we can haul less expensively and we can purchase in truck and trailer load lots instead of carload lots and cut down our investments when we need only small quantities of certain materials. We can make deliveries direct from the wholesaler to the customer and eliminate the necessity of unloading large shipments into our sheds only to reload and deliver to the job.

"That the motor truck is doing a great deal toward making the lumberman's job an easy one is true, beyond a doubt. True, there are some jobs which the motor truck cannot do, but its use in the lumber industry has grown to such an extent in the last few years that its value cannot be denied. Modern industry demands the best means where conditions are at all favorable."

As can be seen from the foregoing, the truck has made good with a vengeance, bringing the firm many benefits beyond the simple one of cheaper hauling. A study of the equipment used, the manner in which it is used, and the figures thereon, would benefit many lumber firms which now think their business so different a truck would not fit in.

Ninety bus lines in Maryland have an average of three vehicles per line carrying an average of 16 passengers per vehicle that operate over an average distance of 19 miles per one-way trip.

There are 36 electric traction companies now operating buses. These are located in various sections of the United States including Boston, Mass., Bakersfield, Cal., Minneapolis, Minn., and Fort Worth, Tex.

The number of men engaged in the manufacture of motor vehicles in the United States is 256,000.

Used Car Situation Shows Need for Careful Buying

Survey of the Situation Shows Dealers Have Been at Fault With Too Liberal Allowances for Old Cars.—Two Recommendations—Scranton's Way

A VERY large part of the present second-hand car problem can be laid to the dealer who in his eagerness to dispose of his allotment of new cars has made too large allowances for used vehicles, is the verdict of the National Automobile Chamber of Commerce after surveying the used car situation. It is admitted that the problem is a serious one, and that the very large number of used cars now in dealers' hands is going to prove a tremendous handicap in the coming selling season, besides which the total amount of capital used up in these used cars is very large, and at present is yielding no return, nor is there any prospect that it will.

How serious the situation has grown, and its influence all along the line, can be gathered from a news item from Davenport, Ia. Prices of used cars in the middle west have been very low, and constantly getting lower, as the agricultural element absolutely refused month after month to buy. But the lower limit, the absolute zero, was reached in the city mentioned when a dealer there recently announced a one cent sale. That is he offered to sell a going car at one cent to any person who bought a similar car at the list price.

The N. A. A. C. says in referring to the situation that no dealer should take in a used car except at a price which insures profit on resale. Present conditions are unusually acute because of the emergencies of the readjustment period, these including financial requirements of manufacturers, the need to keep dealers supplied with new cars at proper prices, and the specific trade allowances which some manufacturers have given to their dealers.

On the other hand, the directors of the N. A. C. C. appreciate the shortcomings of some dealers, and the unscientific way in which they have cared for their side of the problem.

Used Car Market Fundamental

While the second hand car problem has always been a pressing one, the readjustment period has made it worse until now it is the biggest barrier to the successful marketing of motor cars and motor trucks at wholesale or retail.

The owner who bought a car at the high prices of 1919 and 1920 is not inclined to accept the trade-in value based on present new car prices. He dislikes to take the increased loss resulting from the readjustments of prices in all commodities.

From surveys made, it is evident that little improvement can be expected until dealers and branches taking used cars in part payment for new cars make certain to "buy them right."

Many plans have been tried, and many more have been suggested, but the strong outstanding feature seems to be the failure of retail automobile merchants to learn true values and to buy used cars at a price that will insure a profit when sold. No good merchant should be expected to do otherwise.

It is estimated that automobile dealers and branches during the past 12 months have sold $200,000,000 worth of used cars at little or no profit. It is felt that something is radically wrong when that amount of retail business in America is done at a loss.

In most cases new car dealers have suffered this loss.

Used Car Specialists Prosper

Merchants who specialize in second hand cars have made profits.

It is true the second hand car merchants deal only in late models, but many of these late models are bought from dealers at substantially less than had been allowed for them.

The directors are endeavoring to make this survey without bias, touching on the good and bad points of the operations of both manufacturers and dealers.

Requiring dealers some times to take their full allotment, overproduction of certain cars, rushing production to use up old inventories and giving inside trading allowances are among the things attributed to the manufacturer in developing the present situation.

Education Will Aid

Interviews with dealers prove that handling used cars could be made a profitable business provided they would through their salesmen, educate their customers to the true value of second hand cars. Substantial dealers insist that there will be little difficulty if all dealers taking in used cars would learn not to just accept them in trade but to buy them for resale at a profit. Make a virtue out of a necessity and buy second hand cars with enthusiasm and with knowledge that when bought right they can be sold at a profit.

Dealers interviewed agreed that the greatest step toward helping the used car problem is for dealers taking cars to "buy them right."

While much of this survey relates to passenger automobiles, it applies even more so to motor trucks, although not a few students of the industry feel that second hand trucks should never be bought by the dealer in new trucks, but that as long as the truck gives service it should be retained by the owner.

Many suggestions brought out at this last members' meeting are being listed in this pamphlet, all with a view of bringing more suggestions.

The directors are anxious for help from members and from dealers, bankers and others interested.

This preliminary survey is to supply the good and bad points of the various plans offered with a request for constructive criticism.

Dealers Strongly Favor Two Plans

Of the plans offered, many of which are excellent in theory, but which are not workable, either because of the question of legality or the well known failings of human nature, there stand out two very definite proposals, which, if adopted promptly, dealers declare would better the situation.

First—Each manufacturer in advertising his new cars, shall also advertise the market price of his older models.

Second—Dealers in each locality to authorize one or more independent and impartial appraisers (similar to

real estate appraisers) who, for a fee, paid by the dealer or the car owner, shall give the sales value of any car submitted by a dealer or a customer.

Advertising Used Car Values

Under Plan 1, the manufacturer would advertise the sales price of his old models in good condition, based on reports from around the country. This is a development of the used car market report similar to the Chicago plan, but would be more official and more widely distributed. It should not be necessary to give sales values on cars less than a year and a half nor more than four years old.

The plan would give some protection to the new car dealer because a customer could hardly ask for a greater allowance than he knew his used car could be sold for.

Any dealer exceeding the allowance, would do it with the knowledge that he is taking a loss. He then probably will sell the car promptly at the known sales value rather than keep it for months endeavoring to obtain the excessive amount he allowed.

This plan, it is felt, would increase the respect for the second hand car, because the manufacturer would be giving true, accurate information on values.

It would also encourage buyers to enter the market for used cars.

Official Appraisers in Each Locality

Under Pan 2, the dealers in each locality would authorize a sufficient number of appraisers to appraise second hand cars offered in trade. The appraiser would have proper quarters with experts to drive the cars, judge the condition of the parts and tires and be prepared to issue a certificate to the owner giving the value of the car, which certificate would be recognized by any dealer.

The dealer or the car owner would pay a fee of $2.00 or $3.00 to the appraiser, who would be entirely independent of any particular dealer. He would be appointed for his ability, just as a real estate appraiser is recognized by real estate firms.

Customers Are Usually Just

Such a plan would give dealers a true knowledge of the value of the car they are about to buy. There would be nothing to prevent any dealer from allowing a sum in excess of the appraised valuation, but when so doing he would be inviting a loss with his eyes open. Customers, as a rule, are fair, and expect a dealer to make a fair profit. Unfortunately, owners of used cars over-estimate their value and with no official appraisement in opposition are generally good enough salesmen to sell the dealer a car for more than it is worth.

Report On Used Cars Sold

On the ground that broader knowledge of second hand values would be to the advantage of the dealer and the car owner there has been a favorable attitude toward used car market reports for each locality which would make public the prices paid to dealers for used cars during the previous week. This published record would show values just as daily stock exchange tables indicate the value of stocks and bonds.

What the Members in Meeting Suggested

At the members' meeting there were many suggestions offered for the betterment of the situation. Some members and some dealers declare there is little that can be done which will bring any improvement.

The majority, including your directors, are not willing to admit that the situation is hopeless, but are convinced that this industry is big enough, and that manufacturers and dealers have the brains and vision to develop some plans that will make for greater stability for this weak department of the business and still be fair to the buyers of motor cars and motor trucks.

It offers a challenge to our business leaders that cannot be ignored.

Plans of the typewriter, cash register and other industries, have been considered, but it is agreed that our situation is hardly comparable, although there is much that we can learn from those older industries that have dealt with the trading-in problem.

The members' meeting brought out the following suggestions:

1. Make better cars and fewer.
2. Get suggestions of what to do from ecah member and conduct a joint campaign. (National Used Car Week).
3. Treat the used car customer with the same respect as the new car buyer.
4. Give service at a fair price.
5. Give larger dealer discount. (Many disagreed.)
6. Campaign to show that mere transfer of ownership does not mean depreciated value.
7. Recondition the car before selling.
8. Establish local cooperative repair shops where cars of various makes can be reconditioned at cost.
9. Put your major selling efforts into selling reconditioned cars.
10. Guarantee satisfaction or money back.
11. Be especially careful of car or truck allowances made to business houses as this becomes a permanent record.
12. Cover used car question in dealer contract, requiring reports on potentiality of territory so that he will not get overstocked.
13. Have sound bookkeeping and financial practices with regard to used cars so as to have credit standing.
14. Try to concentrate as far as possible in trading in one's own make of car.
15. Treat local used car dealers fairly. Let them have parts at factory price so that the used cars can be sold economically.
16. Dealers must (must not) have a separate used car department. Opinions were offered on both sides.
17. High grade men should be placed on used car sales.
18. Dealers should insist on giving demonstration of new car before bargaining on old.
19. Do not give discount for quantity.
20. Give reconditioned cars same guaranty as new. (Some disagreed).
21. Make each salesman sell every car he takes in unless it is obsolete.
22. Just as many salesmen and just as good salesmen should be selling second hand cars as new cars.

Reports from big motor car centers have tried to show heavy losses sustained by dealers on used cars, whereas, losses charged against second hand cars were really losses on new cars because of the over-allowance on used cars.

Just how many second hand cars are for sale in the country is not known and would be difficult to obtain. It has been estimated that there is an average of 5 for each of the 30,000 new car dealers, plus the cars in the hands of second hand car dealers, and plus those cars which individual owners wish to sell.

The new car market is certain to be slow until the over-supply of used cars is liquidated.

Reasons for the Trouble

Over-production is considered a primary cause of the situation. Plants pushed to meet the demand at the end of the war acquired a momentum that carried over the peak. Bank loans had to be met, so finished product had to be moved. Pressure was brought to bear on dealers to take their allotments and in some cases they were encouraged with inside billings or special trade-in bonuses to make excessive allowances on old cars taken in exchange.

As a result a huge stock of used cars has accumulated in dealers' hands the country over which has tied up their capital so that they cannot take more new cars until they dispose of these second hand cars.

How the Scranton Dealers Handled It

A plan has been put into effect in Scranton, Pa., by the dealers there working cooperatively. This combines the good points of the plans in use in Saginaw, Mich., Hartford, Conn., and Indianapolis, Ind. The whole situation is placed in the hands of a sales board.

Briefly summarized, the plan calls for a personal estimate quarterly from each dealer of what ought to be the selling price of each model of his cars made in 1921, 1920, 1919, 1918 and 1917. These are to be sent to all dealers who are members.

The sales board will then be able to distribute to its members a list of fixed prices on all used cars and the prices of this list are to be quoted by the dealer on his trade-ins. Prices as listed will be those for cars in first-class condition. Fifteen percent is allowed the dealer as the cost of selling and handling the car. If the car is not in a first-class condition, the dealer deducts that expenditure which he will have to make in order to put it into a first-class condition, and with the further deduction for handling, arrives at the price to be allowed the prospect.

Meetings are to be held weekly, nonattendance at these meetings subjecting its members to a fine. For violating the rulings of the board a penalty may be imposed and the offending dealer's membership in the association suspended. The plan for handling the situation is given here in detail:

(a) Have each dealer submit quarterly or on call by the secretary, to the secretary for compilation his opinion of the selling price of each model of his cars made in 1921, 1920, 1919, 1918 and 1917. These values shall be compiled in looseleaf form vest pocket size and distributed to the members in good standing. (Esitmates made by members of cars handled by nonmembers shall be averaged and listed.) The basis for arriving at above stated selling value of a car shall be as follows:

List the average selling price of each model based on your experience of sales of cars in first-class condition.

First-class condition meaning:

Not requiring painting for one year.

Upholstery and top not in need of repair or replacement.

Tires to have at least 10,000 miles value in combined tires and extras.

Mechanically fit for hard use. (Requiring no repairing.)

(b) On the compilation of these values the books will be distributed to members and the information given therein used to determine allowances on trade-ins as follows:

First find the selling price of model in question.

Deduct 15 percent for cost of selling and handling.

Deduct cost of painting.

Deduct cost of upholstery or top repair or replacement.

Deduct cost of replacing tires to bring up to 10,000 miles value.

Deduct cost of mechanical work necessary.

You will then have the allowance you can safely make on the car.

(c) No car more than 5 years old shall be traded.

(d) All cars sold for owner's account shall be sold for a 15 percent commission.

(e) Cars not handled in Scranton or cars not listed in our selling price book shall use the Blue Book selling price value as a basis for figuring allowance.

(f) Each dealer must report weekly used car sales.

Each dealer must report weekly used car inventory.

These reports will be compiled and used as a check against over valuation by dealers and as a barometer for the reducing or raising of allowance prices.

Rules

1. A governing board of five members shall be appointed by the president to act until the next annual meeting.

2. Meetings shall be held each Tuesday. On the days the Scranton Automobile Trades Association meets, the meetings shall be held in conjunction with theirs at a time set by the president.

3. At these meetings on any question brought to a vote only one member of each dealer shall vote.

4. At these meetings shall be only the heads of each business or their representatives.

5. The cost of luncheon at these weekly meetings shall be paid by those attending.

6. At these meetings violations shall be reported, ideas exchanged and used car sales reports and inventories shall be delivered to the secretary.

7. The governing board shall have the power to act on all special cases not covered by these rules and duties and their decision shall be final.

8. It shall be the duty of the governing board to hire the necessary help and material to carry on the necessary work involved.

9. It shall be the duty of the governing board to compile the weekly reports of used car sales and used car inventories.

11. Trade allowances, obsolete models, etc.

In event the dealer has a trading allowance from the factory or is willing to cut his list price for reasons of his own, or desires to quickly sell certain models that may soon become obsolete, he shall at once advise the governing board the amount of the cut or allowance, though he need not explain his reasons. When such dealer handles trades, however, he shall quote only regular allowance figures. The object being to put everybody on an even basis and not give the public a wrong impression of the value of the used car.

12. Customer desiring change of type.

When a customer purchases a new car and decides within 60 days that he wants to purchase another car from the same concern the dealer may make the exchange on any basis satisfactory to himself and the customer.

Fig. 1. Motor truck hauling sheep to market, along the Dixie Highway, near Covington, Ky.

Fig. 2. Truck and trailer with 18 tons of logs on the Pacific Highway in British Columbia.

Teaching Highway Economics as a Science

New Book Has Been Prepared by Prominent Professor to Be Used in Schools and Universities in Teaching Distribution of Traffic and Safety Education.

THE great, one might almost say the tremendous, importance which good road surfaces have assumed in our modern scheme of living and doing business is brought out by the fact that highway economics are now considered as a science, worthy to be taught in our schools and universities. With this idea in mind, a comprehensive outline of highway transport, from the time when aboriginal man invented the first wheel to the present moment, has been prepared by Prof. Lewis W. McIntyre, assistant professor of civil engineering, University of Pittsburgh, for the Highway and Highway Transport Education Committee.

Although making no pretense of being complete, the outline treats exhaustively of the various phases which make highway transport one of the dominant subjects of the day. It was prepared at the urgent insistence of schools of engineering and economics, highway engineers and highway officials. The outline is expected to be the forerunner of text books on the subject, to which many of the leading economists and engineers in the country are giving their attention.

The outline, published in pamphlet form, may be adapted for classroom exercises and lectures, or it may be used by engineers and business men actively engaged in the manufacture of motor vehicles or the construction of highways.

Subdivided into five divisions, the outline treats of the field of highway transport, the highway and the motor vehicle, legal phases of the subject, principles of successful operation and the selling of transportation.

One of the subdivisions deals with the inter-relationship of highways, railways and waterways, showing how the transport trinity may be so coordinated that the most effective distribution of commodities may be attained.

The relationship of highway transport to traffic engineering and city planning, treated in the outline, opens a broad field of speculation, presently to become to economists, engineers and investigators, the subject of specific analysis.

One of the most immediate phases affecting highway transport, the distribution of traffic and the safety of the pedestrian and the motorist, is treated at some length, the views of men and women who have given considerable time and thought to this subject having been previously ascertained. Historically, the outline goes back to ancient days when loads were carried on the backs of men and

Fig. 3. One of New York's municipal trackless trolleys, on the Richmond Turnpike, Staten Island

Fig. 4. Without the concrete surface this load of 32 bales of cotton near Savannah, Ga., would be impossible.

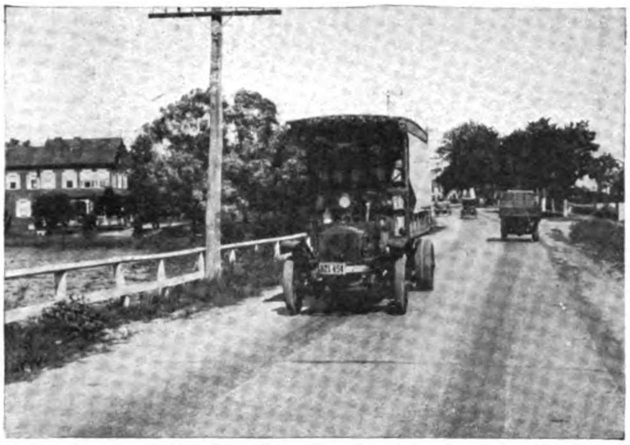


Fig. 5. Perishable farm products on the way to market in Suffolk County, N. Y., via motor truck.

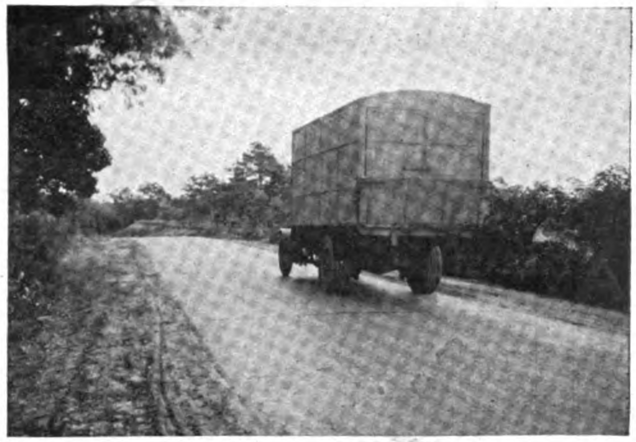


Fig. 6. This huge closed body contains supplies for New York from the farms and gardens of Long Island.

women, treating successively the coolie labor, South African negroes, pack animals, the invention of the wheel, and presently, its evolution into carts, chariots, and the motor vehicle of today.

As a preface to the outline Professor McIntyre says: "The outline makes no pretense of being either complete or adequate. It has been limited in various ways. The newness of the subject and the consequent lack of authoritative research make definite conclusions and principles impossible. An effort has, therefore, been made to avoid the expression of an option, but to present both sides of debatable questions. Some of the topics are capable of considerable expansion; their use will be determined by the local situation. Others may be used almost as outlined. It is confidently expected that use of the outline will develop innumerable suggestions for its revision. Such suggestions or criticisms will be appreciated."

One of the features of the outline is the bibliography that follows the topics under each subhead. Another that is expected to be of definite value to the motor transport operator are the chapters on costs, dispatching and route. The selection of the motor vehicle, dealing with general requirements, type, body design, trailers and tires, will prove, it is said, an invaluable asset to the purchaser.

The booklet is being distributed by the Highway and Highway Transport Education Committee, first to colleges and universities and then upon request to manufacturers and business men. It is interesting to recall that the committee, appointed in May, 1920, by Dr. P. P. Claxton, then commissioner of education, has been able within a comparatively brief period of time to enlist the interest of engineers and economists in a field of transportation held to be an increasingly important factor in the national life.

The sole function of the committee is the study of highway transport in its abstract phases, and to that end consists of men qualified by experience and training to undertake the study, and to encourage it.

Dr. John J. Tigert, United States commissioner of education, is chairman of the committee.

Thomas H. MacDonald, chief, Bureau of Public Roads,

The booklet is being distributed by the committee from its offices in the Willard building, Washington, D. C.

In connection with it, the photographs reproduced herewith, showing the great varieties of uses to which concrete roads are put, will prove of interest. The great variation from the transportation of live stock in Kentucky or passengers on Staten Island, N. Y., to cotton in Georgia, logs of wood in British Columbia, or milk in Wisconsin, will be noted as well as the fact that all of this traffic is motorized. The ubiquituous motor is reaching out into every field of human endeavor, and daily new uses are being found for the motor truck which formerly were considered impossible for it. Better than all that, it is proving economical of both time and money in all this widely-diversified work.

The photographs are shown through the kindness of the Editor, Concrete Highway Magazine, published by the Portland Cement Assn., who kindly loaned them.

Fig. 7. Winter milk traffic in Milwaukee County, Wis., is as regular as in summer.

Fig. 8. Common carriers and freight trucks on the road in Los Angeles county, Cal.

Rural Motor Express Opportunities for Investment and Career

BY THOMAS F. SYNDER*

Necessity Great for Motor Transportation in Our Distribution System and Chances This Brings for Profits and Building Up of Big Business.

AT LEAST one-third of the products necessary to American life and progress require a new and better method of transporting and distributing them, and in this dire industrial and social need there is a tremendous opportunity for men with vision. This statement may seem bold and even ridiculous to the entrenched, middle of the road, let well enough aloners, but let me quote the inspiring words of James Russell Lowell:

"New times demand new measures and new men. The world advances and in time outgrows the laws that in our father's day were best, and after us no doubt, some purer schemes will be worked out by wiser men than we, made wiser by the constant growth of truth.

"The world is ripe, and rotten ripe for change; then let it come, I have no fear of what is called for by the instincts of mankind nor do I fear the world will fall apart if we but tear a parchment more or less."

The rural motor expressman is going to bridge a very narrow and yet a very deep chasm between two foundation stones of human society, namely the industrial consumer and the agricultural producer.

To a very great extent the industrial problem of production has been solved, but the more important problem, that of distribution, has awaited the arrival of the motor truck and the highway. To substantiate that statement I call attention to the fact that during the war American industry produced in super-abundance, while transportation and distribution were woefully overtaxed.

During the war our Indianapolis transfer organization took over the task of clearing a congested freight house. We found repair parts to important machinery, and other shipments pending the arrival of which production had been halted and had waited for weeks, buried under tons of less important freight.

Motor trucks and highways are proving themselves great conservators of power and energy, because they are the short connecting links in the chain of activity in all industry. In order that I may make clear the possible application of the motor truck to transportation and production, let me give here some startling facts secured from a series of surveys made at Indianapolis.

In Indiana we are accustomed to boast of our wonderful system of electric interurban railways, 13 of which enter the city of Indianapolis, yet at one traction express office the industrial loss, caused by delays to vehicles waiting before a limited unloading platform to discharge loads, amounted during a normal period of five days to from $126.50 per day to $280 per day, or an average of over $60,000 per year.

Lage motor trucks with shipments of less than 1,000 pounds waited in line for periods of one, one and a half and two hours, and in many cases the shipments could have been delivered to destinations 20, 30 or 40 miles away while the motor truck waited to discharge its load at the traction company's platform.

A survey of the steam railroads revealed the fact that from 3,500 to 5,000 freight cars are lying on side tracks in and about the city of Indianapolis awaiting limited terminal facilities all of the time. Also the further startling fact that for all "less than car load," and short haul shipments, the average car is held in idleness awaiting loading or unloading for more than nine-tenths of its time.

The industrial loss, caused by demurrage charges due primarily to limited terminal facilities, congested freight yards and houses in Indianapolis is over $25,000 per year. I find from a great number of inquiries that Indianapolis is not an exception to other cities of its class, in either or all of these industrial leaks.

Another great loss and inconvenience, and one rarely mentioned, is that suffered by merchandise receivers and the general public in delayed deliveries, due to one or a number of the above causes.

During the world war a survey was made by Dr. H. E. Barnard, federal food administrator for Indiana, in an attempt to ascertain the proportion of farm produce which never reaches the consumer or the market, because of its maturing too slowly to provide a profitable load to market at any given time, and because the farmer is rarely ever sure of market conditions, and because a large proportion of vegetables and fruits mature during harvest time, when the farmer and his entire family find it necessary to stay on the job of production. The results of the survey in two remote counties of the state of Indiana proved the lost proportion of food stuffs so great that the matter was reported to Washington and was taken up at a conference of federal administrators for general discussion.

In general, if the industrial loss due wholly to our present antiquated, inefficient methods of transportation and distribution could be ascertained, the figures would be unbelievable. If, on the other hand, the American people knew the extent of this loss, and could be shown in cold facts and figures the great relief and economy which would result from the application of the motor truck and the highway, the good roads movement would need no more propagandists. However, economic necessity and industrial evolution are great factors in rushing us pell mell toward a solution of many of these problems.

When the armistice was signed, the Return Loads Bureau at Indianapolis was shipping more than 600 tons of commercial freight and express out of Indianapolis each month, on motor trucks that would otherwise have returned empty to the rural communities. These trucks were engaged principally in hauling farm products to the central market.

The traction companies exerted enough pressure to force closing the return loads office at the stock yards, but the return loads movement was not crushed. The truckmen and the merchants over the motor routes had learned

* Chairman highway transport committee of Indiana. Presented through cooperation of National Automobile Chamber of Commerce.

the lesson of economy, convenience and profit in the movement. Many rural motor express routes operating through Indiana today had their start in the live stock truck with a return load of merchandise.

The shipper is rapidly learning that he must add the cost of getting his products on board cars to the shipping cost, that delays of vehicles at congested or limited warehouse and freight platforms are not an overhead, but a shipping cost. The rural motor expressman can be paid a much larger transportation fee than asked by steam or electric railways, at a financial saving and an added convenience to shipper, receiver and the general public.

Shippers and receivers are rapidly learning that to tie up a freight car for 24 hours in loading, then putting it in action for a short haul of but two or three hours' run, and then tying it up again for from 12 to 24 hours in unloading is bad industrial economy, and that the loss must be borne by some one, principally the public, which includes them.

in Indiana, both about the same distance from Indianapolis, and 15 years ago of the same size.

At that time an electric traction line was built through one of these towns which developed an immediate increase in population as well as an increased industrial activity. In 10 years it doubled its population while its unfortunate neighor had lost one-third of its population. Five yea.s ago several enterprising merchants in the smaller town started rural motor express routes to Indianapolis, hauling not only their own merchandise but that of their fellow business men including their own competitors.

All merchants began to polish up their stocks, the town radiated a new spirit, the farmers who had forsaken it returned again, trade and industry was so stimulated that today, Monrovia, Ind., connected only with other industrial centers by a fleet of motor trucks, is putting up a winning contest with her electrically connected competitor.

Type of vehicle and load, in the transporting of which lie great opportunities, as the Author points out herein. Diamond T Farm Special.

Railways have realized for years that the short hauls are not only unprofitable, but that they interfere seriously with speed and thereby the profits in handling the long hauls. Economic necessity and the crying need for better distribution demand that the short haul go to the motor truck.

The rural motor expressman will put a new life and a new pulse into every little town and hamlet throughout this broad land; he is the coming savior of the small town merchant who has been almost completely put out of business by the great mail order industry. The truckman links the small town merchant up with almost a daily and a dependable service to the nearest jobbing center, and because of such service enables the merchant to offer his trade a larger, better and fresher line of merchandise. A splendid illustration of this influence is found in two towns

Large ice cream and butter manufacturers are rapidly adopting the motor truck for gathering cream from the rural districts and during the summer months are glad to pay five cents per pound more for cream brought to the city by rural motor expressmen than that brought by steam or electric lines. The wise rural motor expressman has learned how to serve his business. He picks up the cream at the cooling station of the dairyman, protects it from the sun, and delivers it to the creamery before bacteriological culture has set in for which he collects his transportation fee, and the additional five cents per pound as a reward for service.

During an experience of two years the rural motor express division of the Indianapolis Chamber of Commerce has found no difficulty in loading trucks running into small towns. Small town merchants can readily be shown the

advantage to their trade, of the quicker motor truck service. More than half of the perishable fruits shipped by commission merchants out of Indianapolis during last September were shipped on motor trucks. Tons of candy, bread, drugs, groceries, hardware and dry goods were shipped by truck.

The Roadside Market

Let us return again to the farm survey of unmarketed food stuffs. During a period of from three to four months of each year, during the highest productive period of the farm, at least nine farms in ten will show a daily loss in food stuffs the total of which in any county would be beyond belief.

The average farmer in discussing the matter looks upon it as unimportant, the quantity is not great, perhaps only a bushel of tomatoes, a few bushels of applies, or other fruits or vegetables. There are plenty more coming; he is too busy to go to market, especially with a small quantity, also, the commission merchant may not want it. The farmer is not a salesman and does not like to find a buyer, so the daily loss of countless tons goes on, while hundreds of thousands of housewives wonder how they can make the food allowance tide over until next pay day.

The rural motor expressman will solve this problem to a very great extent by developing the "from farm to table" movement. There are more than 2,000 large, well made roadside market signs scattered along the principal highways of Indiana. The sign indicates what is ready for the market today. The farmer's wife or children will be in charge and the wise rural motor expressman will become more than a transportation agent; he will be a commission broker, a jobber; he will know the market, because the most successful rural motor expressmen operating in and out of Indianapolis during the past summer were those that transported general merchandise from jobber to small town merchant, and returned with food stuffs from the farm to the city retail grocer. We hope during the coming summer to establish in Indianapolis, a wholesale market where the rural motor expressman may transfer his load to the city huckster who delivers directly to the consumer, thus making "farm to table" service a reality.

The rural motor expressman reaches directly the base of both supply and demand. Can anyone question for a moment his importance in the better scheme of distribution? The rural motor expressman is also finding a new field of service and profit.

The roadside market signs in addition to "for sale" also carry a "wanted" column, the rural motor expressman becoming the broker between the farmer who has a plow or calf for sale, and the farmer who wishes to purchase a plow or a calf. This brings the rural motor expressman in constant touch with the farmer who is rapidly becoming the expressman's best customer, and who is also learning the economy and safety of continuing production while the rural motor expressman hauls his entire product to the market and brings to him his agricultural implements and his family's needs.

Farm labor is already dangerously scarce and the rural motor expressman is becoming as essential to the farmer as his tractor, and as essential to industry as raw material.

The motor truck offers immediate relief for car shortage, freight congestion, limited terminal facilities, transportation and distribution of perishables. It is a new vital artery into every town and hamlet; it is a conserver of time and energy; it is a new connecting link which will make more powerful and thereby more productive the current of activity throughout all industry.

It has been truthfully said that we still lack the highways over which to operate the motor truck, and yet if we accept the highways as they are and apply the motor truck as it can be applied, the industrial economy will provide the means, during the next 10 years, with which a national system of highways can be built, and by which our entire scheme of transportation and distribution will be revolutionized.

Now then let us analyze and summarize what it is necessary to do and how it is to be done, if we are to assist and accelerate the application of the motor truck to highway transportation. I used the terms "assist" and "accelerate" because I believe that the motor truck will find its full place in the world's affairs through the process of industrial and economic evolution, but if we are to assist and accelerate its application, we must educate the truck owner and operator as to his true position and relation to industry as it controls or influences his success. Highways transportation as an industry has been injured more by unwise adventures than it has been benefited by successful ones.

I have advised against the immediate establishment of at least 10 rural motor express routes during the past 30 days, but have agreed to assist all of them beginning March 15. These men were not equipped to stand the strain financially or otherwise until the normal demand for their service would make it both pleasant and profitable.

I recently refused support to a group of small town merchants and their surrounding farmers who proposed to put $50,000 into a rural motor service between Indianapolis and Cincinnati because they so overestimated the immediate returns, and proposed to begin operation on such a large scale that disaster would have been inevitable.

The average truck buyer is very often "over-sold" by the truck agency in that he is made to feel that a great demand for his service is awaiting him. This is not true as an immediate business resource, especially so, since four out of five men to whom this industry appeals, are men who have little business and less sales ability.

During the past year I have prevented at least 10 trucks from going back to agencies by providing business for their owners. I found men who had been induced to mortgage their household furniture to make a first payment on a motor truck. They were without telephone service, any kind of stationery, business cards or business ability. The agency that sells a motor truck under such conditions is not only a menace to the industry, but it is an industrial criminal. I have found in most cases that it takes about 30 days to create a real demand for rural motor express service over almost any route. The merchants, manufacturers, shippers of all kinds along the route, must be written a number of times and told of the service. We supplement this effort, in Indianapolis, by getting the jobbers and wholesalers to write their customers along the route, asking them to specify motor truck shipment on their orders. The truck owner and operator must be taught the advantage of his service over the existing service.

Shippers and receivers must be definitely shown the great industrial loss, the unnecessary delay, and incon-

venience to which they are being subjected at present. These should then be contrasted with the better motor truck service.

Shipments which best fit motor truck transportation must be solicited first. Shippers who benefit by increased motor truck service should be shown their obligation to use it whenever possible.

Chambers of commerce, automobile trade associations and business men's organizations should be shown the business advantage and their moral obligation to foster and support rural motor express and return loads departments.

In Indiana, we have taken it for granted that the entire public must be educated on the application of the motor truck to highway transportation and shown all of its advantages. One of the means we used was to get out a full page of matter for the papers. A page of this type was sent three times a week to all the daily papers and a page of different matter was sent once a week to all the weekly papers. In this way all the people were fully informed as to the benefits of motor transportation.

We have the state so organized that in every large industrial center, we have somebody who is willing to assist in reporting return loads. In addition to that we send out cards to all the truckmen in the state. They are addressed to the return loads bureau at Indianapolis, and the truck man fills out the reverse side of the card, saying that tomorrow or next day or next day, "I will be in Indianapolis and expect to return empty. Can you find a load back for me?" We then find some shipment consigned in his direction so that he may have a return load.

We also use another card. This is an endorsement by the merchant in the city. One of our great problems has been insurance of a shipment before we had rural motor express insurance. The jobber was reluctant to give to any truckman a load of valuable merchandise, and so we devised a card, which is an endorsement by the retail merchant of the truckman in his own town. This releases the shipper from obligation in case of damage. The plan worked very effectively.

Much literature was published in booklet form. Business men throughout the state were constantly posted as to the progress of the movement.

There is no question but that, as yet, we have not carefully studied the great problem of distribution and transportation. Now that the movement is developing throughout the country there is no doubt but that the motor truck and the highway will be more and more used as instruments in distribution.

Yellow Tail Lights

Automobile engineers are considering the advisability of using yellow in place of red tail lights so as to minimize the danger of motorists confusing lights placed along highways to indicate dangerous road conditions with automobile tail lights.

The members of the passenger car and motor truck standardization committees of the S. A. E. have studied this proposed change and generally approve of it. The fact however that the use of red tail lights is required by law in many states will mean that the change to yellow tail lights cannot be made until the laws in these states are revised.

American Influence Felt in German Design

It is interesting and instructive to remark the present trend of design in the German automobile industry.

There is a movement to abandon several typical German features and to follow American design in some respects. Six-cylinder engines exhibit a tendency to increase in numbers, and it is current practice to equip such engines with two carbureters, one for each group of three cylinders. Overhead valves are almost universally employed, and the most favored method of operation is by an overhead camshaft. Central control is slowly becoming popular. Generally speaking, coachbuilders retain the typical German characteristics of V-shaped radiator with appropriate bonnet and scuttle lines and the disappearing hood. The all-weather hood is also receiving attention. Eight-cylinder engines are represented by only one example, a V engine with overhead valves operated by a camshaft situated between the two groups of cylinders. This car has front wheel brakes.

Interest has been aroused by the special Mercedes engines, and although two examples were staged at the recent Berlin show the details were not made visible, and the utmost secrecy was maintained regarding the design. Apparently, the engines are designed for super-charging by means of an air-compressor, somewhat on the lines of the super-charged aero engines. These cars, although built as touring vehicles, are said to have attained a speed of 120 kilometers per hour, but the manufacturers state that experiments will still proceed, and that it will be at least nine months before these models can be marketed. Apparently, considerable trouble is experienced in designing an efficient cooling system for these engines.

Another interesting development is the six-cylinder Maybach car rated at 70 h.p. It is said that no gears are incorporated in this model, and that speed changes are produced solely by the flexibility of the engine in conjunction with a special carbureter. Apparently, the carbureter is designed on the principle of surface evaporation and is controlled by a variation of the surface area. At slow speeds the surface is enlarged, and at high speeds it is reduced. A feature of the design is that a very large battery is provided for the starting motor, the reason being that this motor has also to operate the reverse. There is, apparently, a low gear available for emergencies. The elimination of the multi-speed gear box results, of course, in a car which is particularly easy to drive, the control being entirely by accelerator pedal.

The Rumpler car is of very unconventional design, the engine and transmission being housed at the rear of the car.

Amongst the smaller vehicles exhibited is a cycle car with a five-cylinder rotary engine incorporated in the single front wheel and driving by an epicyclic gear.

Plans Out for New Steam Car

Production is in course of being started by the Barlow Steam Engineering Syndicate on a new steam car designed by L. P. Barlow, which is expected to sell for about $3,000. The new enterprise is headed by C. L. Lamson of the Penberthy Injector Co. with A. G. Wadsworth and L. P. Barlow as trustees. The construction of the boiler is a feature of the design upon which considerable emphasis is being laid. Plans for production contemplate putting the car on the market by June 1.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

Paul Morse Richards, *President* G. A. Tanner, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIV APRIL, 1922 No. 1

Is Further Price-Cutting Wise?

RECENT action by one of the large automobile manufacturing companies, turning out a very popular air-cooled car, in cutting the price of its vehicles, just before the opening of the touring season by amounts varying with the model, but all in the neighborhood of $600, raises an important question. Practically all makers have now cut down from the very high levels of war times and conditions, the plans of today's prices having been reached after what might be called two revolutions, that is two complete cycles. Since the last one, the public has become convinced that the bottom has been reached, that prices being as low as they would go, it was time to buy.

They have been doing this recently with a vim, as is reflected in factory reports showing January output and sales much larger than January of last year, February perhaps 50 percent larger than January, and March still bigger by an equal or greater amount. Plans have been revised upward from the pessimistic ones of last fall to the more optimistic trend of the present. Right in the midst of this, however, and just previous to the heavy buying of the year, this new price cut, which is huge in amount and percentage, comes like a bombshell.

Of course there is a reason for it, and it is not the usual reason—poor business. On the contrary, this company is enjoying one of the best and busiest seasons ever. It is a clever move to forestall competition, in that several new air-cooled cars are to be placed on the market this season. For this reason, and from this point of view, it cannot be condemned.

But from the viewpoint of the rest of the industry, that is all the other car and truck manufacturers except perhaps three or four, it is very bad business. The greatest possibilities for trouble lie in the public's attitude toward it, and public expectations of what may follow.

If the public figures that it foreshadows another round of price reductions, and stops buying until this third cycle is completed, trouble will eventuate for a large number of firms, and the industry as a whole will suffer a great deal.

Under the circumstances it would seem wise for some one, some official body, or some individual spokesman who has the public confidence, speaking for the whole industry, to make an announcement that further reductions in prices will not come, cannot come, and advising the car-buying public not to be misled into thinking differently by this isolated action of a single manufacturer, for a good but special reason. While this might seem a very peculiar suggestion, it is one which handled diplomatically and skillfully would benefit all of the car makers but a very few, say 2 percent, all of the dealers except the still smaller percentage restricted wholly to these few makes of cars, and most of all, the vast majority of car buyers themselves.

Advertising Misrepresentations

ONE is sometimes tempted to wonder how much of the gross exaggeration appearing in some of the current advertising of motor cars, parts, and accessories, the real buying public accepts as gospel truth. It certainly would be interesting to know, for instance, how a tire manufacturer can state in the public prints that his product costs no more, and directly beneath this in the tabulated prices indicates that it actually does cost up to 27 percent more, the larger percentages in the more popular sizes. Does this maker think the public does not know the prices of all the other makes, or that reading his announcement, they will promptly forget all they know and rush to buy his product?

Along the same lines, it would be most interesting to know the actual number of persons influenced to buy a certain car, which has claimed for several years to be "the most beautiful car in America." Of course, beauty is largely a matter of opinion, so no one could absolutely disprove this statement, sweeping as it may be. Speaking generally, and along the lines of accepted coach work good lines, this particular maker has never been considered as having the finest proportions, or being in the best taste, or otherwise, being of a superlative nature.

Considering this, the question arises, can a single, unsupported, sweeping claim of this kind be made profitable through endless and continuous repetition? By profitable, we mean of course, can it be made to sell cars, and continue to sell them, cars which could not be sold without this bombastic claim, even if of equal quality in every respect, and at equal prices?

Coats Steam Car to Start Production

Sales offices of the Coats Steam Car Co. have been moved from Indianapolis to Chicago where they are now established at 2337 Michigan avenue. With its acquisition of the factory of the Stewart Motor Car Co. at Bowling Green, O., the company expects to start production shortly. Production plans, as outlined, call for a minimum output of 10,000 cars the first year. It is reported that a phaeton and a roadster will be built each to retail for $1,085, with sedan at $1,495 to follow later. These machines will be marketed under the name of the Stewart-Coats steam car.

Financed by Canadian capital, the Canadian Steam Motors was organized to handle the Coats steam cars for the western part of the dominion. Headquarters are at Victoria, B. C.

The Selection of Steels for Automobiles

BY W. E. JOMINY*

Successful Automobile Construction Calls for Proper Selection of Materials — Steel Used Depends Largely Upon Design Adopted—Ductility as Well as Elastic Limit Must Be Considered

ONE of the fundamentals of successful automobile construction lies in the proper selection of materials. However good the design may be otherwise, failure often results through the improper selection of materials by the designer. The selection of steels for automobiles therefore, will be considered. Questions of fabrication and design will be considered only as they affect this. The subject has been divided into two main parts. The first is a consideration of the various factors governing the proper selection of a steel for a given part. The second part is a discussion of the steels most commonly used in present day practice, giving the relative merits of each.

The kind of steel used in any automobile part depends largely upon its design. Lightness, distribution of metal, rigidity, ample radii at corners, tendency toward warping, all of which are embraced in the design of a part, largely control the steel which shall be chosen for the part. For example, most manufacturers use a high grade alloy steel for the rear axle shafts, yet there is a prominent maker of a medium grade automobile who uses ordinary open-hearth plain carbon steel for this part. Again there is a well known low-priced car, which has heat treated alloy steel connecting rods, while most manufacturers use heat treated plain carbon steel, and one high grade manufacturer uses annealed plain carbon steel for his connecting rods. Obviously there is a great difference in the physical properties developed in these steels, but in any of the cases just mentioned, it is unlikely that the wrong material has been chosen. The differences in materials are largely the result of the different designs. There are a great many other considerations besides design in selecting the proper steel for a given part, but it is necessary first to know approximately what physical properties are required before any intelligent selection can be made. There are relatively few automobile parts in which the stresses can be figured accurately, but in many cases an approximate figure can be obtained. The required ductility for any part cannot be figured in any way, and for this reason there is much conjecture about this property, which is equally as important as the elastic limit of the steel.

Importance of Ductility

Many engineers pay little attention to the ductility required in any given part, and investigate only the elastic limit required. It should be emphasized that the ductility of a steel is equally as important a property as its elastic limit and that failures occur just as quickly, in fact usually more quickly, when the ductility is too low than when the elastic limit is too low. The minimum ductility required for any part must be determined by the cut and try method, since there is no way of calculating it. Fortunately for parts of like function the minimum ductility required is about the same, so that once determined it can be applied generally. For example, the leaves in a chassis spring should have an elongation of about 9 percent or better and a reduction of area of about 28 percent or more to function satisfactorily; and whether the spring is lightly stressed or heavily stressed, or whether it is used on a light touring car or heavy truck, the same minimum elongation is required.

Selection of Steel

To choose the proper steel for a given part then, we will first decide what minimum elongation and reduction of area it will be necessary to maintain, and then select those steels which, when heat treated to give an elongation over the minimum required, will give the desired elastic limit. Usually there will be half a dozen or more steels which will answer our purpose. If the part is subjected to large alternating stresses it may be expedient to further limit the possible number of steels for a given part by choosing those having high Stanton values and high impact values. Even limited in this way there will probably be several steels usable for any part from which must be chosen the most economical one to use.

In many cases properties other than structural are required, such as resistance to wear, resistance to burning, high tensile properties when hot, magnetic permeability, resistance to corrosion, etc. The same method of choosing steels for these parts can be used as mentioned above; the additional properties required simply limit the number of steels from which we must choose the most economical.

The most economical steel is not necessarily the one with the lowest first cost although this is a consideration along with the ease with which the steel can be forged, straightened and machined. Ability of the mill to consistently produce the steel free from pipes, seams and the many inherent defects, as well as possible sources of supply all enter into the problem. These qualities are not easily ascertained and require careful study of their use on a production scale. Experiments carried out on a production scale introduce so many variables that it is difficult to arrive at accurate results. The large difference in shop methods, as well as the differences in the number of cars produced per day, are perhaps the main reason why all shops are not unanimous in the choice of one type of steel.

Chrome-nickel, straight nickel, chrome-vanadium and recently chrome-molybdenum steels each have their staunch supporters, and undoubtedly each excels the others under certain conditions. For any given shop there is generally one steel which proves most economical, and the tendency is to use this wherever possible. This tendency should not be criticized, because it is desirable to use as few steels as possible in a plant. A reduction in the number of steels used means a reduction in the heavy investment an automobile manufacturer has in his stock of steel. It also makes for better purchasing conditions, better production conditions and less chance for

* Metallurgist, Studebaker Corp., Detroit. Paper presented before the Indianapolis Convention, American Society for Steel Treating.

mixing steels. Summing up the manufacturer's metallurgical problem, we find that he wishes as few different steels as possible which will meet his shop conditions economically and possess physical properties to satisfy the requirements of his many parts.

Having these requirements in mind, the following list of steels has been drafted and is intended to cover the needs of a manufacturer who is making all his parts at his own plant. Only the relatively important parts are mentioned, but these steels should take care of all parts.

The Steel Used

(1)—A steel for sheets and strips of average importance. This is usually an open-hearth 0.10 percent carbon steel, the same as S. A. E. No. 1010. It is used for fenders, body plates, splashers, hoods and various stampings. It is finished in most any degree of smoothness desired and annealed in various ways to produce ordinary or extra drawing qualities.

(2)—A good machining steel for ordinary bolts, nuts. screws, studs and many other parts which are lightly stressed. A cold rolled or drawn bessemer steel of carbon content about 0.08 to 0.16 percent corresponding to S. A. E. No. 1112, is generally used. More attention is paid to the machinability of this steel than its strength. It is not considered a good carburizing steel, although it is used for this purpose by some makers of low-priced cars. Because of its easy machining qualities it is popular with men in charge of production work.

(3)—A plain carbon carburizing steel for such parts as camshafts, tappets, spring bolts, water pump shafts, tappets, spring bolts, water pump shafts, front end gears, etc. Following is the common steel used for these parts:

	Percent
Carbon	0.15—0.25
Manganese	0.30—0.60
Sulphur	0.050 maximum
Phosphorus	0.045 maximum

This steel is easily forged and machined although its machining qualities are not as good as steel (2) given above. After carburizing it is necessary to water quench this steel to produce a scleroscope hardness of 75 or more. If the steel is properly heat treated the Brinell hardness of the core will not exceed 200. It is not customary to refine the grain of the core of camshafts, tappets or water pump shafts. In the case of tappets and water pump shafts it is not deemed necessary and in case of camshafts too much warpage is induced. Some makers use a steel ranging in carbon from 0.10 to 0.20 percent for these parts. Better ductility results from the use of this steel but it is more difficult to machine.

(3-a)—Stampings, parts made from seamless tubing and frames are made from the same analysis given under (3). Frames also are quite commonly made from a 0.20 to 0.30 percent carbon steel, other elements the same as under (3).

(4)—A forging steel of medium carbon for parts not too highly stressed, commonly used for connecting rods, crank shafts, front axles, spring clips, brake levers, etc. Many manufacturers use alloy steel for these parts and, as previously stated, the design largely determines which steel must be used. The medium carbon steel, however, is the most economical steel for these parts and if the design permits this steel will be used. If the design requires steels of higher physical properties some of the alloy steels which will be discussed later can be used. Following are the steels generally used in this group:

	(a) Percent	(b) Percent
Carbon	0.30—0.40	0.35—0.45
Manganese	0.50—0.80	0.50—0.80
Sulphur	0.050 max.	0.050 max.
Phosphorus	0.045 max.	0.045 max.

Both of these steels forge easily, respond well to heat treatment and are fairly easy to machine. Unless the sections are very irregular water may be used as the quenching medium. The Brinell hardness to which these parts are usually held depends again on their design but it will be found usually that when made from this steel connecting rods will have a hardness somewhere between 190 and 290, crankshafts between 217 and 290 and front axles between 190 and 260.

(5)—A steel for coiled springs, lock washers, etc. This steel will have the following analysis:

	Percent
Carbon	0.58—0.70
Manganese	0.70—1.00
Sulphur	under 0.050
Phosphorus	under 0.045

Where the size is suitable, coiled springs generally are coiled from wire of this analysis which has been tempered at the mill. After coiling, the springs are given a low draw at about 500 deg. Fahr. to remove the coiling strains and used in this condition. Whether tempered at the mill or heat treated at the spring plant, satisfactory coiled springs will have a scleroscope hardness between 55 and 70.

(6)—A steel for keys, coiled springs of thick wire and ball bearing balls. Following is the steel generally used here:

	Percent
Carbon	0.90—1.05
Manganese	0.25—0.50
Sulphur	under 0.045
Phosphorus	under 0.04

This steel is also used in low priced cars for chassis springs.

(7)—An alloy carburizing steel for parts where resistance to high stresses as well as wear is a factor, as case-hardened gears, piston pins, steering knuckle pins, ball bearing races, etc. Here we find a diversity of opinion as to the steel required. The steels shown in Table No. 1 are most common.

TABLE NO. 1

	(a) Percent	(b) Percent	(c) Percent	(d) Percent	(e) Percent	(f) Percent
Carbon—	0.10—0.20	0.15—0.25	0.15—0.25	0.15—0.25	0.15—0.23	0.08—0.16
Manganese—	0.50—0.80	0.50—0.80	0.50—0.80	0.50—0.80	0.30—0.60	0.30—0.60
Sulphur—	0.045 max	0.045 max	0.045 max	0.045 max	0.045 max	0.045 max
Phosphorus—	0.040 max	0.040 max	0.040 max	0.040 max	0.040 max	0.040 max
Chromium—	....	0.45—0.75	0.80—1.00	....	1.00—1.20	1.00—1.20
Nickel—	3.25—3.75	1.00—1.50	....	3.25—3.75	3.00—3.50	3.00—3.50
Vanadium—	....	....	0.15—0.20	....	....	....

Steel (a) is easy to heat treat and gives highly satisfactory results, producing a very ductile core. Unless carefully prepared, however, it is rather difficult to machine.

Steel (b) machines a little easier than (a), but does not give quite as ductile a core.

Steel (c) is a good carburizing steel, but due to the increasing cost of vanadium, the steel has a rather high first cost.

Steel (d) is easier to machine than (a) but does not give quite as ductile a core and requires a little more care in heat treatment.

Steel (e) requires careful heat treatment to produce a soft core and a hard case, and several concerns have not been able to use it successfully on a production scale. When properly heat treated however, this steel has good physical properties, and has been the salvation of some otherwise impossible designs.

Steel (f) gives excellent physical properties and is much easier to heat than steel (e). Where heat treating difficulties are encountered, steel (f) is often substituted to advantage for (e). Steel (f), however, is more expensive than (e).

All of these steels can be hardened to a scleroscope hardness of 75 minimum, using oil as a quenching medium, in fact, many manufacturers require a minimum of 80. Water can be used as a quenching medium for steels (a), (b), (c) and (d) for some sections, but because minimum warping is desired oil is generally used. Nearly all parts made from those steels are double quenched. An exception to this is the ring gear which is seldom double quenched because the high heat to refine the core produces too much warping.

(8)—A steel for the usually high stressed parts such as rear axle shafts, steering knuckles, propeller tubes, steering arms, connecting rod bolts, highly stressed studs, etc. Where design makes it necessary, front axles, spring clips and connecting rods are also made from this steel. Table 2 shows a wide range of steels used:

TABLE 2

	Percent (a)	Percent (b)	Percent (c)	Percent (d)
Carbon	0.25—0.35	0.25—0.35	0.25—0.35	0.30—0.40
Carbon	0.30—0.40	....	0.30—0.40	....
Carbon	0.35—0.45	....	....	....
Manganese	0.50—0.80	0.50—0.80	0.50—0.80	0.30—0.60
Sulphur	0.045 max	0.045 max	0.045 max	0.045 max
Phosphorus	0.040 max	0.040 max	0.040 max	0.040 max
Chromium	0.45—0.75	0.80—1.10	....	0.60—0.95
Nickel	1.00 —1.50	....	3.25—3.75	2.75—3.25
Vanadium	....	0.15 min.	....	....

Where different carbon ranges are given it should be remembered that the lower the carbon content the easier the steel is to forge, anneal, machine and heat treat but also the lower the carbon the lower the physical properties of the steel.

Steel (a) is a popular steel. It forges rather easily, is not difficult to anneal, responds well to ordinary heat treatment, although in general requires oil quenching, and gives good physical properties.

Steel (b) forges easily, is easy to anneal, is easily heat treated and far less sensitive of over heating than (a), (c) or (d). It can be quenched in water and gives good physical properties. Due to the high cost of vanadium, the first cost is rather high and because of higher heats required to treat it, is a little harder on the furnace.

Steel (c) is rather easily forged, is not difficult to anneal or heat treat, but the hardness does not penetrate well in large sections. In small sections it gives satisfactory physical properties. This steel also seems to have more inherent defects than the others.

Steel (d) is rather difficult to forge, difficult to anneal, requires careful heat treatment but gives excellent physical properties. Usually when steel (d) is used in a manufacturer's plant it is because of some one particular part and he makes all of his other parts in this group out of steel (a), (b) or (c).

Chrome-molybdenum steel has been introduced recently as an automobile steel with what seems to be a promising future. At the present time, however, it has not been sufficiently used in quantity production to include it in our list.

(9)—A steel for gears. This function requires all that we can get from a steel. We must have resistance to wear, to shock, and to very high stresses. There are still quite a number of cars made with carburized gears and in this case one of the steel under (No. 7) is used. The general consensus of opinion seems to be, however, that all things considered, the oil hardened gear is more satisfactory. The following are the more common steels:

TABLE 3

	(a) Percent	(b) Percent	(c) Percent
Carbon	0.45—0.55	0.40—0.50	0.45—0.55
Carbon	0.40—0.50	....	0.40—0.50
Manganese	0.30—0.60	0.50—0.80	0.50—0.80
Sulphur	0.040 max	0.045 max	0.040 max
Phosphorus	0.040 max	0.040 max	0.040 max
Chromium	0.60—0.90	....	0.45—0.75
Nickel	1.50—2.00	3.25—3.75	1.00—1.50

Steel (a) is difficult to forge, difficult to anneal, hard to machine, must be heat treated with great care but gives excellent results. The steel with the lower carbon ranges eases these difficulties.

Steel (b) is a little easier to forge and anneal than steel (a) but in large sections the hardness does not penetrate as well as in the other steels. It does not have physical properties as good as (a).

Steel (c) is somewhat easier to forge, anneal and machine than (b) and has about the same physical properties.

Gears made from these steels and heat treated to a scleroscope hardness of 70 to 75 seem to give the best results.

(10)—A steel for chassis springs. We have already discussed the plain carbon steel that is used for lightly stressed springs. There are three other steels which are commonly used which have the following analysis:

TABLE 4

	(a) Percent	(b) Percent	(c) Percent
Carbon	0.45—0.55	0.40—0.50	0.65—0.75
Manganese	0.60—0.80	0.80—1.00	0.85—1.05
Sulphur	0.045 max	0.040 max	0.035 max
Phosphorus	0.045 max	0.040 max	0.035 max
Silicon	1.80—2.10	....	0.30 max
Chromium	....	1.05—1.20	0.30—0.45
Vanadium	....	0.15 min.	....

These steels all give good results. Steel (c) is generally conceded to be the best of these three, but it is more delicate and consequently more difficult to handle than the other two. The hardness of the spring leaves should be as close to 400 Brinell as is commercially possible to maintain.

(11)—A magnet steel. The following analysis is common for this purpose:

	Percent
Carbon	0.80—0.90
Manganese	0.30—0.50
Silicon	0.25—0.40
Chromium	1.90—2.10
Tungsten	0.75—1.00

(12)—A valve steel. Strength, resistance to wear and resistance to scaling at elevated temperatures characterizes a good valve steel. Most of the lower priced cars have valves made from a cast iron head cast or welded onto a machine steel stem. These valves resist scaling at high heats, quite satisfactorily but warp and pit easily. If better materials are required one of the steels shown in Table 5 should prove satisfactory.

The principal merit of steel (a) is in its relative cheapness. It is easier to forge and machine than the other steels in this group and has the lowest first cost. It does not resist scaling well but will not warp as easily as the cast iron head valve.

(Continued on Page 30)

New Lexington Model U Includes Valuable Refinements

Economy the Keynote of This Redesigned Chassis—Makers Call It Their "Ultimate" Model—Great Comfort from Improved Frame Design—Other Details.

WHEN a number of the present motor cars were produced as new models, a couple of years ago, it was difficult to see in what particulars they could be improved. They appeared then to represent the last word in motor car and body construction. Yet each year, designers find a few small but exceedingly valuable improvements which they can make, a slight addition here which makes for greater economy, a little change there which improves the riding qualities, another little variation there which has some other desirable influence, and so on.

When the Lexington car with its Ansted engine was announced this was the case; it seemed like the last word in design, construction and value at the price. Yet the Lexington engineers, led by J. C. Moore, the inventor of the Moore multiple exhaust used on all their models for several years, and of a number of the other features of the car, have succeeded in making a material improvement in that model. Thus, the newest product of the Lexington Motor Co., Connersville, Ind., known as model U, shows quite a few changes, all of which represent such an advance over the previous model that the firm calls it the "ultimate" model.

Some of the things which have been built into the new U chassis and body will meet with instant approval, for they include greater comfort, in which the new frame and new springing are important factors; endurance and economy, that is economy of fuel, oil and tires as well as upkeep; decreased work for the owner in keeping up his car, through improved lubrication of the engine, of the clutch, of the spring bolts, and of other parts; superior performance which is brought about by better engine output through small but important refinements, lower center of gravity of the whole chassis, and others.

These points are best evidenced by the fact that in this new chassis there are 14 entirely new features and a host of other units which have been improved to such an extent that the car is almost revolutionary in the new standadrs of motor car quality it has fixed.

Greater comfort, with that enduring quality that makes the purchase of this car a permanent investment, and performance standards that would be hard to excel even in larger and more costly cars, are the principal advancement aimed at in the development of this new chassis.

Among its new features may be listed the frame, three units of which are entirely new and the other two improved. The new units consist of a combination front cross member and front motor support, making the front end of the frame more rigid; an entirely new type of double triangular center cross member, 30 in. wide, preventing frame twisting, and a rear frame section which carries spring horns made deeper, with wide gussets to prevent side swaying.

To provide greater riding comfort, front springs are now 38 in. long by 2 in. wide, or 4 in. longer than on former models. Rear springs are 59 in. long by 2¼ in. wide, or 3 in. longer and ¼ in. wider than on former models.

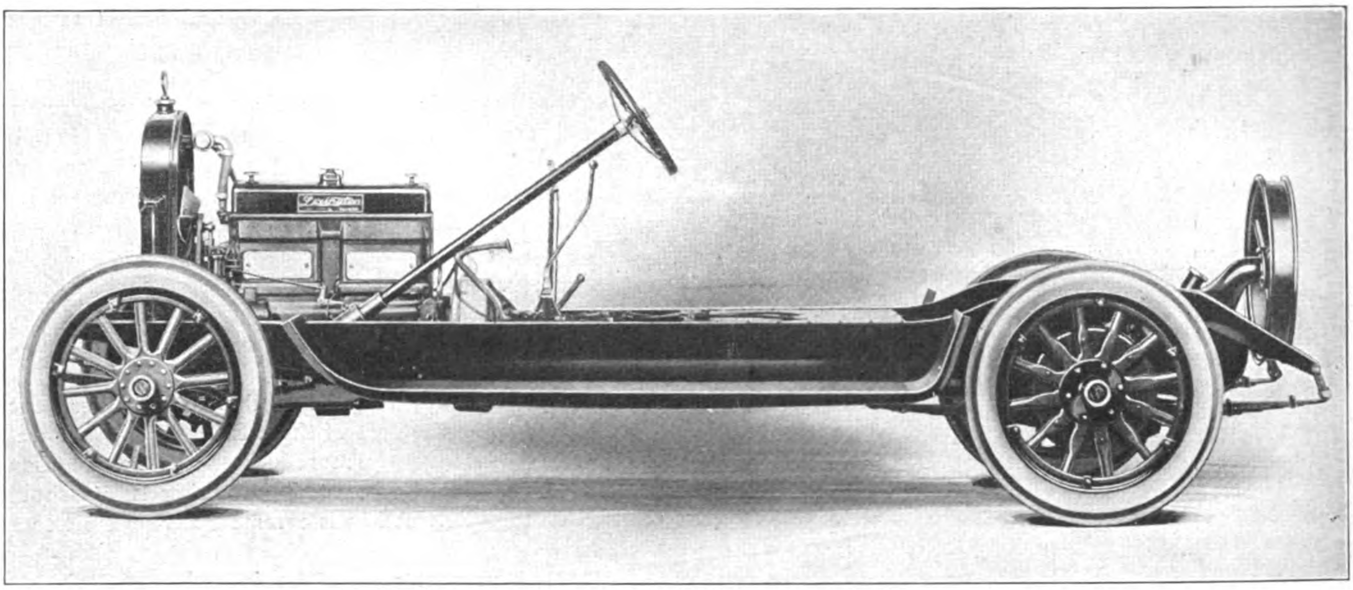


Fig. 1. Side view of the Lexington Model U chassis, showing lower, longer lines and many detailed improvements.

This is well shown in the left-side view of the complete chassis, shown in Fig. 1. There it will be noted how long and flexible the springs appear, while the combined chassis frame and running board construction can be noted as well. These same points can be well seen in the plan of the chassis, shown in Fig. 2. This represents the job as it would appear from directly above. Note how the frame is of a perfectly straight taper from front to rear, also note the central and rear frame members, to be described.

Appearance and performance have been improved but it is in economy in the use of not only fuel, oil and tires, but in reduced cost of upkeep that the engineers have realized their greatest achievement.

Service in this new car is built-in at the factory before the car reaches the owner's hands. In other words, the factory has made certain of both operating and mainte-

nance standards before the car has been put on the market. For instance, the lubricating system is better than ever before. And proper lubrication means longer life for any mechanism. This improved lubrication applies not only to Ansted engine bearings and other working parts

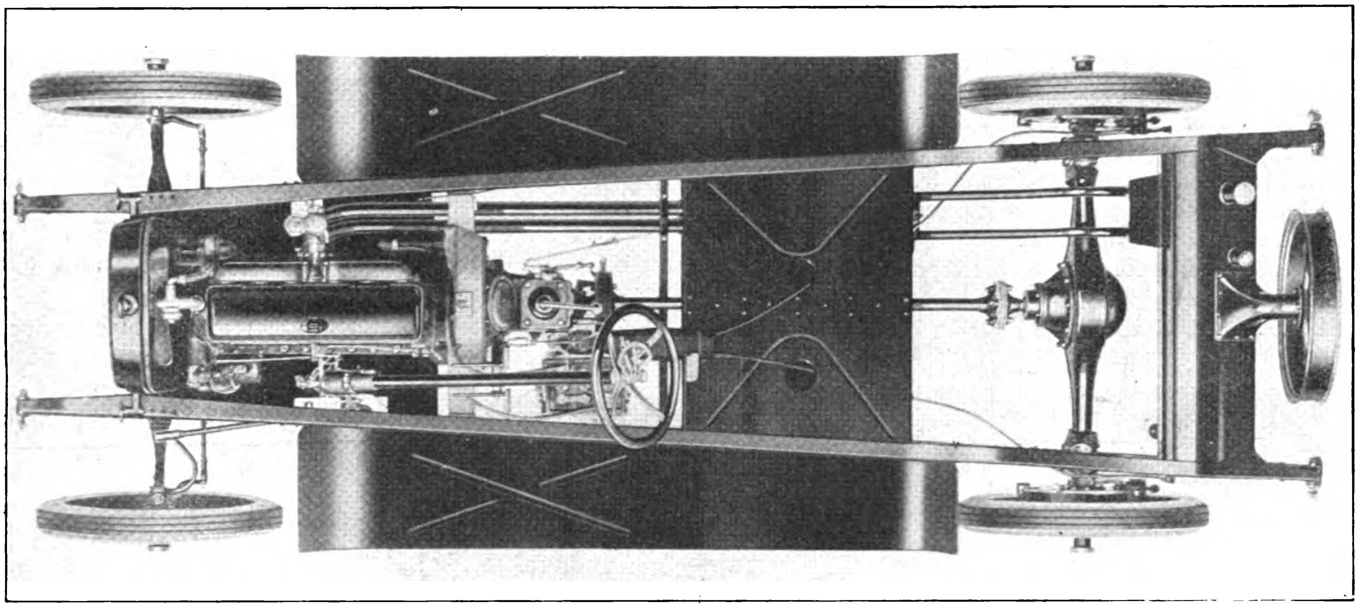


Fig. 2. New Lexington chassis, as seen from above. Note particularly the new large central frame cross member.

but to chassis, springs and spring bolts, all served with lubricants under pressure.

Other new spring features are boots to keep out water and preserve lubrication, enlargement of spring bolts to ¾ in. in diameter, except the front end of rear springs which are 1 in. in diameter, and round head bolts on front end of springs so side play can be eliminated by tightening nuts. All spring bolts are fitted with force-feed oilers.

A new feature of the clutch is an annular type throwout bearing in a stationary housing, with an oil reservoir.

Another new and exclusive feature is the two-way head lamp control which is mounted on the steering column and operated by turning the horn button.

The Ansted engine, with which all Lexington models are now equipped, has been improved by three new features and several other refinements. For example, the water pump is driven by a "V" belt with automatic belt tightener integral with drive pulley. A spring in the fan mounting takes up slack in the belt when clamp screws are loosened.

This remarkable engine, which was described in detail in an earlier issue of Automotive Manufacturer, is shown from the left, or ignition side in Fig. 1, and from the right, or carburetion and exhaust side in Fig. 3. In the latter the multiple exhaust pipe can be noted, also the details of the spark plug position, the wiring, the generator, pump and other engine units, also the clutch and transmission.

The new model has a wheelbase of 123 in., yet the car has unusual riding ease due to longer front and rear springs which give not only added comfort but longer life.

The new Lexington also has a very low center of gravity. In other words, the chassis weight is carried close to the ground which has given it marked roadability, freedom from sidesway, and "road-floating" qualities unexcelled in other cars, even of much higher price.

By referring back to Fig. 2, and also to Fig. 4, some of these special features may be observed. Note in the lat-

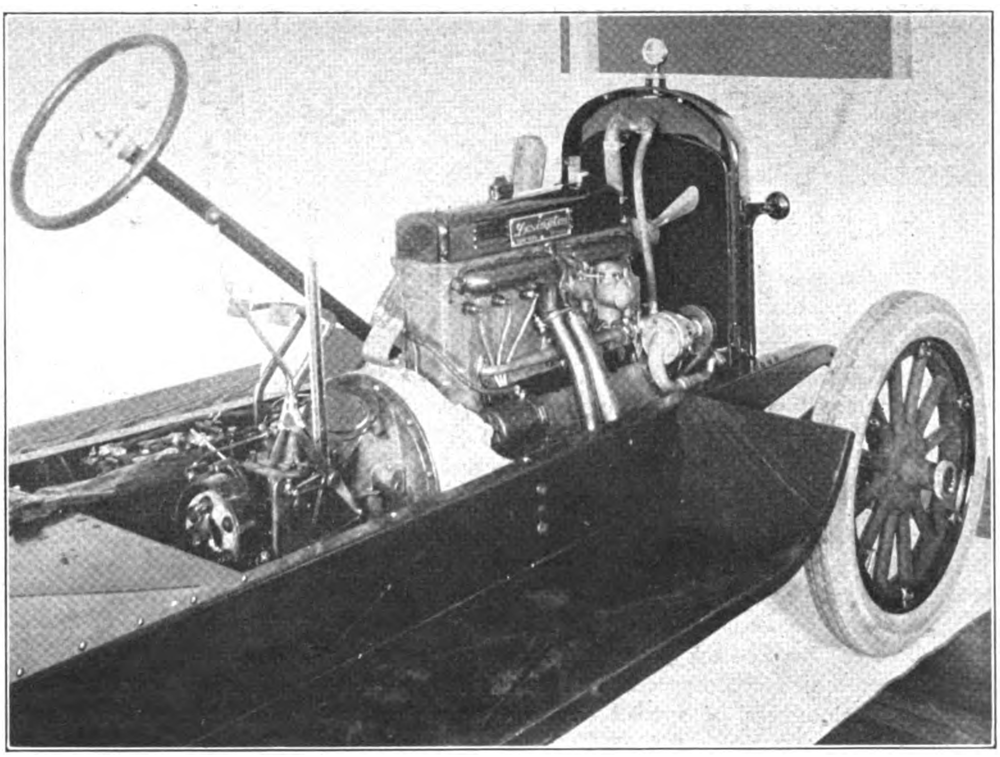


Fig. 3. Forward end of the new Lexington U chassis, showing Ansted motor, clutch, transmission and operating levers.

ter illustration how the double exhaust pipe is carried out over the rear axle, and under the fuel tank, to exhaust independently at the rear of the chassis. Observe in this view also, how the central frame cross member of very great width extends almost to the front point of attachment of the rear springs.

To make the battery more accessible, it has been located under the front floor board, which is divided on the center line of the car.

Another new improvement is an automatic locking turnbuckle adjustment at the pedal, making adjustment of the cable service brakes extremely simple.

Front and rear bumpers, designed on scientific principles, are standard equipment.

All these and other points, the interested reader will be able to study out in the illustrations herewith, which cover the mechanical features very well. Body views are not, unfortunately, available at this time, but in a general way can be summed up as equal in all respects, and superior in many, to previous Lexington body work.

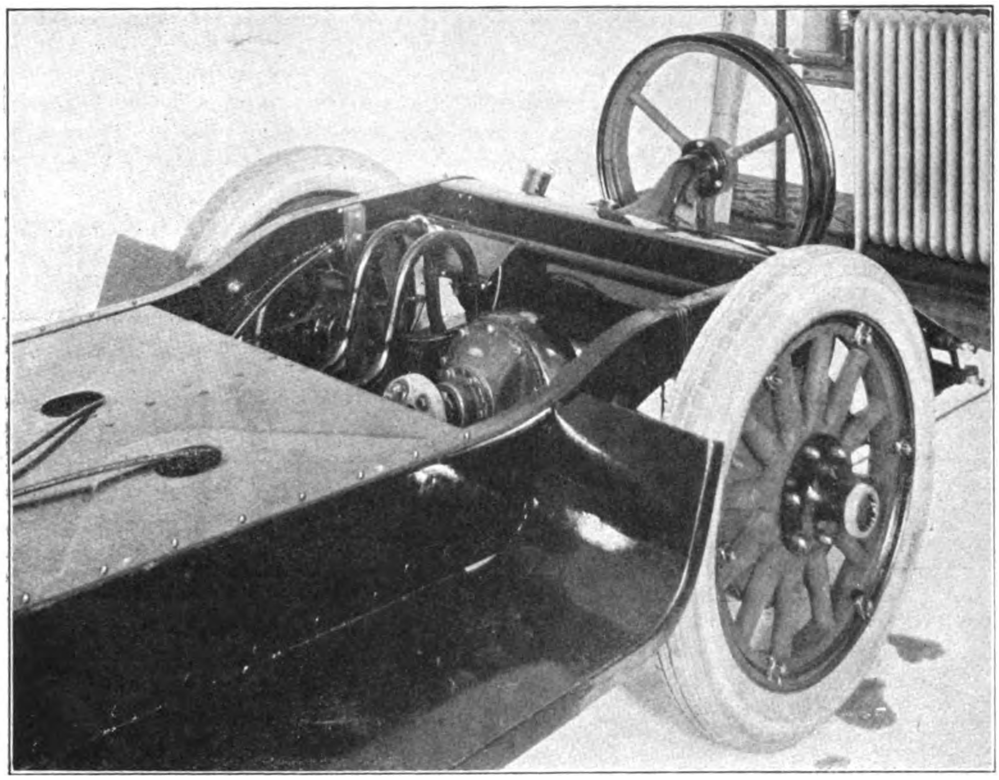


Fig. 4. Rear end of the new Lexington U chassis, showing frame details, including the new cross member, tire carrier, etc.

There is nothing freakish or bizarre in the new body lines. They are dignified without being severe; fresh without being flashy—a design that will endure as long as the car itself.

More than that, they boast in appointments every physical necessity for successful motor car operation and exclusive improvements not to be found on any other car regardless of price or size. Included in these are two-way anti-glare head lamps; the Moore multiple exhaust system, which eliminates back pressure from the motor; the Lexi-gasifier, which literally volatilizes every drop of gasoline; spring bumpers of special design; motor meter; spring bolts; cord tires; power tire pump; windshield wiper; stationary inspection light under hood, and real leather upholstery throughout.

French Auto Industry Getting Back to Normal

According to Baron Petiet, president of the Syndicate of Automobile Manufacturers, the French Automobile industry has passed the severe period of the general industrial crisis, and is gradually getting back to a more normal state.

During the war most of the automobile manufacturers in France were busy turning out war materials, and the building of cars was almost negligible. The reason for this was that the French government found it comparatively easy to purchase abroad such vehicles as were needed for the transportation of troops, whereas it was much more difficult to procure arms, munitions, aeroplane engines, gun carriages, etc., at short notice.

At the end of the war the automobile manufacturers found themselves with enlarged factories equipped with the latest machinery and tools, but deprived of many of the things that were essential to the resumption of normal trade.

In the first period which followed the armistice most of the factories were flooded with orders which could not readily be filled on account of the difficulty experienced in procuring the necessary raw materials. These rose tremendously in price, upsetting the manufacturers' calculations and in many cases causing severe losses. Later came the crisis in business and industry generally, and sales dropped almost to zero. Now, however, orders are again coming in to the factories and the industry has recovered an almost normal activity.

France's exports, in 1920, of automobiles and accessories reached a total value of 1,187,972,000 francs. Increased domestic usage of the automobile by the general public is expected because of the decreased price of gasoline. The price in 1919 was 15 to 16 francs per can of five liters (about 4½ quarts). The present price is 1.7 francs per liter. In some places it can even be purchased for 1.55 francs per liter.

During 1921 the United States shipped to Alaska 70 passenger cars, valued at $75,242, and 15 motor trucks, valued at $10,279. The registration of motor vehicles in Alaska shows a total of 384 passenger cars and 153 motor trucks.

A survey made by the New York State Bureau of Municipal Information shows that in 1921 over 6,000 motor vehicles were owned and operated by 60 out of the 100 largest cities in the United States. Fire apparatus and privately owned cars of which the city pays operating expenses are excluded from the above total.

New Knox Cyclic Cracking Process Promises Much

Commercial Importance of Gasoline and Crude Oil Supply and Production Warrants Consideration of Every Process Which Appears to Increase Totals.

BY AN American invention just perfected the automobile is destined to enter upon a new era of usefulness, comfort and economy of operation. Its present lack is an ideal fuel. This is promised in the form of a high-explosive gasoline produced on a large scale at moderate cost. Such gasoline is now made for flying machines, which depend upon a fuel that never fails. For automobiles, which in this country used more than 5,000,000,000 gallons last year, it has not been obtainable for the last five years. But, thanks to the new process, that boon is at hand. What it means may be inferred from the statement of H. M. Crane, representing the Automotive Engineers at the recent annual meeting of the American Petroleum Institute:

"In my opinion the ideal fuel (and I am going to say this at the risk of being called a dreamer and impractical) is in the order of aviation gasoline, that is a fuel beginning its distillation curve around 150 deg. Fahr. and ending around 350 deg. I may say so because I know that that fuel can be used economically and efficiently in the simplest form of apparatus we know of by anybody at all who can drive a horse or guide a plow."

The last boiling point, the end point, as engineers call it, of most gasoline is between 420 and 500 deg. By the impending method full supplies of approximately 350 deg. endpoint can be made as cheaply and easily as the prevailing high endpoint gasoline, thereby eliminating what Mr. Crane told the Petroleum Institute is "a very serious matter," the cost of which, if it could be determined, "would," he believed, "be found to be something staggering." High endpoint gasoline wastes 30 percent of the fuel used by the average motor car, besides causing secondary explosions or "knocking," increases the use of lubricating oil, and decreases the life of the parts of the engine.

The new method can be used, also, nearly to treble the gasoline now taken from crude oil on a commercial scale, by converting not less than 60 percent of the heavy residue or fuel oil into gasoline. The Burton process, the one used by the Standard Oil Co., converts only 33 percent of such oil into a less volatile gasoline, but by the new method no less than 75 percent can be obtained of such quality.

These facts, of extraordinary importance to the automobile and other gasoline-driven industries, are so well established by competent experts that a corporation has been formed to proceed under patents covering the invention.

The secret has been carefully guarded during the experimental period and not much detailed information is yet available. The author is William J. Knox, for many years associated with the late George Westinghouse in chemical and engineering research. Hence the name, the Knox Cyclic Cracking Process.

Its success depends upon the effective and nondestructive results of exposing oil to super heated hydrocarbon gases. At the present time there is no better means of making gasoline than the primitive one of heating and boiling it off in a kettle. High pressures are used to raise the boiling point so that heat enough may be employed to "crack" out gasoline in anything like sufficient quantity. But the recovery is relatively small, little more than a quarter in volume, and the waste by burning or carbonization is great.

In making the gasoline approximately an equal amount of oil is thus broken down into tar. The waste is direct and indirect. Direct through the oil lost and indirect through long interruptions necessary for carbon and tar removal.

Mr. Knox claims to strike out both losses. He exposes widely distributed oil in earthenware lined chambers to gases heated at maximum to 1,200 deg. The streams of oil and gas are constant as is the off-flow of the products of the "cracking" and there is no burning. It is because of the very high temperatures that can be thus applied to crude oil, without waste of time or material, that the recovery in gasoline can be augmented no less than three fold.

For the cyclic cracking great savings in operation are also claimed. The fuel cost is substantially less than for the present pressure-stills and the labor required is reduced by automatic control and the simplicity and continuity of the operation.

What is foreseen, in effect, is nothing short of a revolution in the oil industry. Because of the immense demand for gasoline to meet the requirements of more than 10,500,000 motor vehicles in this country alone, to say nothing of other gasoline consumers, the utmost products of oil stills have to be "extended" by the heavier naphthas and some parts of the kerosene. By the new means the supply, vastly increased, will be undiluted. Today "gasoline carries the oil refining business." This is true because the gasoline is so much more valuable than the other products.

The statistics for 1921 show that this country produced 469,639,000 barrels of crude oil and increased this amount by importation to 525,407,000 barrels. We produced 5,153,549,318 gallons or 122,703,555 barrels of gasoline which sold for an average price at the refinery of 15½ cents per gallon. In other words the gasoline was 23 percent of the total oil used and paid the refiner $798,800,144. On the other hand the amount of low grade fuel oil made was 44 percent or 230,090,860 barrels which sold for an average price of $1.05 or a total of only $230,090,860. Fuel oil thus had to be sold for a much lower price than the cost of the original crude and constituted an uneconomic by-product. It amounted practically to twice the quantity of gasoline made and sold for only one-third of the value.

These figures explain why gasoline "carries the oil industry" and intimate the effect of a change which will so radically increase the recovery of the most valuable product.

It is estimated that the annual motor truck mileage of the United States is 7,150,000,000 and that 1,430,000,000 tons of freight are transported annually over highways by motor trucks.

Gasoline from Oil Shale

BY RALPH H. McKEE*

Preliminary Discussion of Present Sources of Gasoline and Its Possible Substitutes — Cracking Processes—Scotch Shale Oils—Fuels from Molasses.

PROBABLY the best plan is to start with a clear definition of the various terms to be used, since they do not always mean the same thing to different people. Gasoline may be considered as a hydro-carbon distillate, generally a petroleum distillate, 90 percent of which boils below 374 deg. F., and all of which boils below 437 deg. It has a density less than 50 deg. Baume. To be commercial gasoline, it must have slight color and be free from certain impurities.

Oil shale is a type of shale occurring in considerable quantities in various parts of this country—notably the western states—and in many other parts of the world. On heating, this gives a petroleum from which motor spirit similar to ordinary gasoline can be obtained. The word petroleum was used for shale oil some 20 years before the discovery of the first oil well.

Twenty years ago all the gasoline used was obtained as the light, low boiling point distillate from crude petroleum. This, which might be called crude gasoline, was then chemically treated to give refined gasoline. The chemical treatment consisted in stirring it with concentrated sulphuric acid to remove the coloring materials, ill smelling compounds, certain substances called unsaturated compounds, and small amounts of certain basic constituents. After this acid wash, gasoline was washed with an alkali, generally caustic soda. Following this, it was redistilled and a very fine quality of product resulted. It is quite easy to make good quality gasoline from such a quality of petroleum as Pennsylvania petroleum, but when the Pennsylvania fields began to decrease in output and the lower quality of oils from Ohio, Canada, the middle west and the far west came into the market, it was found that they did not give either as large a percentage of gasoline or a product of as high a quality as had been given by the Pennsylvania oil. On the other hand the demands for gasoline due to the growth of the automobile industry were increasing.

The effect of this change of the commercial situation was that lower grade gasolines began to come into the market. These were lower grade in that they carried some of the higher boiling kerosene fraction, some color and some of the unsaturated constituents which give a stronger odored product. Each phase of this lowering of the standard brought about distinct increases in the amount available, but even under these circumstances the demand has increased faster than the supply, and accordingly there have been attempts to use other products to supply the deficiency. These attempts have given rise to three new petroleum products, casing head gasoline, natural gas condensate and cracked gasoline, as well as substitutes quite different from petroleum products.

When a higher boiling petroleum, of the type of the low priced fuel oil or gas oil, is heated to a temperature of 700 deg. F., there is a decomposition of this oil with separation of carbon on the one hand and the formation of light boiling constituents of the type of gasoline and kerosene on the other hand. This process is known as the cracking of oil and the lighter of the commercial products made is known as cracked gasoline. Cracked gasoline carries up to 40 percent of unsaturated compounds. Formerly we considered that a gasoline carrying as much as 5 percent of unsaturated constituents was not desirable or available for use in an explosive engine. Today much of the gasoline on the market is a mixture of cracked gasoline carrying 40 percent, with straight distillate gasoline of low unsaturated content. In New York it is not uncommon to have gasoline put into your car carrying 20 percent unsaturated constituents. This unsaturated product means that you have a gasoline which on standing and in contact with the air becomes colored and after a time even separates a small amount of brown tar-like deposit. This red-brown sample was formerly a water-white cracked gasoline of 30 percent unsaturates. It also has a more unpleasant odor than the saturated straight distilled gasoline. On the other hand, who of you purchases gasoline as a perfume or on its looks?

The automobile of a few years ago would not run well on the present day gasoline. It is certain that the gasoline on the market is destined to grow in its content of unsaturated compounds, and we must look to the engine designer to at least keep up and even with the changes in the type of fuel available.

There are several schemes which have been used on a which are 1 in. in diameter, and round hea dbolts on front large scale for making cracked gasoline. Of these the one which has been used on the largest scale is that of Dr. W. M. Burton, now president of the Standard Oil Co. of Indiana. This is the process now being used by various Standard Oil companies and by which they make approximately two million gallons of gasoline a day. Burton starts, as do all other cracking schemes, with a cheap petroleum residual, preferably one of the Pennsylvania or mid-continent types. The particular point in which his process is distinctive is that he heats under a pressure of about 75 pounds, and does not relieve this pressure until after the vapors have passed through the condenser. Heating of the oil is accomplished in a steel tank by a fire placed directly beneath it. The temperature varies during the process, but averages perhaps 700 deg. F.

Any scheme of cracking is handicapped by the deposition of coke on the bottom and side of the still. Burton's process suffers severely from this trouble. The original patent claims that the process gives a product free from unsaturated compounds. However, the products at present made do carry a considerable percentage of unsaturated material. The method is fairly cheap to operate but suffers, as before mentioned, from heavy flinty carbon detors, and also because the products formed are too unsaturated to be of the highest grade.

Other workers have attempted to get away from the

* Professor of Chemical Engineering, Columbia Univ., New York City. Abstracted from address presented before Section of Physics and Chemistry, Franklin Inst., Philadelphia, Pa., January, 1922.

posits, high deterioration of stills, the dangers of opera-troubles of the Burton process, in particular the heavy carbon separation and unsaturated character of the product. Doctor Rittman while a graduate student at Columbia University developed a process in which the cracking is carried out in the vapor phase instead of as a liquid. His apparatus consists of externally heated vertical pipes through which the vapors are passed under pressure. The process is one in which a pressure of 300 lb. may be used. A temperature of about 700 deg. F. is used. By reason of the reaction being in the gaseous stage instead of liqquid, the amount of carbon deposited is small, the products, however, like those of Burton, are partially unsaturated.

The third process which has been carried out in commercial plants is that of McAfee. Dr. McAfee, like Dr. Rittman, is also a graduate of Columbia. McAfee avoids the use of pressure and obtains a sweet smelling, strictly saturated gasoline. This he accomplishes by a chemical reaction of quite different type from that of Burton or Rittman. He works at ordinary pressure and at quite moderate temperatures, say 500 deg. F. He heats the oil to be cracked with a few percent of its weight of aluminium chloride. This chemical, aluminium chloride, reacts with the oil to give a coke-like carbon and low boiling hydro-carbons of the type designed for motor fuel. The one handicap has been that it has not proved possible economically to recover the aluminium chloride for reuse, and the selling price of gasoline has not been high enough to permit the throwing away of the chemical after one use.

Many an oil well gives at the same time considerable amounts of gas as well as oil. If this gas is examined it is found to be formed in part by the evaporation of the same volatile constituents as are present in the liquid petroleum. If we condense the low boiling liquids from this gas we will obtain a very volatile gasoline. Gasoline obtained from the gas coming from the top of the casing of an oil well is called in the industry "casinghead gasoline." There are several methods of condensing this casinghead gasoline. If an air compressor is taken and this used not to compress air, but to compress the gas coming off with the oil from the well it will be found that part of the gas is condensed to a liquid. This liquid when drawn off is found to be desirable and highly volatile gasoline. In fact its volatility is so high and its density so low that it can be mixed with higher boiling constituents such as kerosene and the resulting product appear to be a gasoline of ordinary type.

Many times instead of depending on compression alone the compressed gas is bubbled through a high boiling solvent such as gas oil and the resulting solution of gasoline in the absorbent oil later distilled to recover the gasoline and absorbent oil for reuse.

In still other plants the absorption is not by means of a heavy oil but by absorbent carbon. Silica gel is a new material which promises to displace the absorbent carbon and gas oil for this purpose as it is a still better absorbent.

We have also found that many (but not all) of the natural gas wells which furnish gas but no oil, carry considerable gasoline in the gas. Gas wells of West Virginia and of Pennsylvania in general are of this type. Gasoline can be recovered from these in the same way as it is recovered from the casinghead gas of the oil well.

Whether recovered from the casinghead gas of an oil well or from a straight gas well, the gasoline obtained is of such a character that at the present day it is most all used for bleeding purposes to bring the lower grade gasoline to a higher grade. The amount of this condensed gasoline available is minor as compared with the requirements of the country.

As stated before the requirements for gasoline are increasing year by year by very considerable amounts. We, in this country, have had gasoline cheap and in comparative abundance. This has not been true the world over. We consider 40 cents a gallon high, but most of the world would welcome gasoline at 60 cents a gallon and call it cheap. Europe is using and has been using as a motor fuel for some time large amounts of benzol, obtained as a by-product from its coke and gas plants.

The Scottish shale oil plants have been furnishing considerable quantities of a motor spirit from oil shale. Cuba has had a surplus of molasses; this molasses on fermentation giving alcohol, and Cuba has been making extensive use of this alcohol not only to furnish visitors from the United States with a beverage, but also locally it has taken the place to a considerable extent of gasoline for automobile uses. Natal, of South Africa, has also an abundant supply of alcohol from its waste molasses. Imported gasoline is quite expensive and, accordingly, they have devised a product which goes by the name of Natalite, and which has largely taken the place of gasoline in that part of the world. This Natalite is a mixture of alcohol with about 45 percent of ether. In the United States we have had but one commercial attempt to supply a gasoline substitute. This is the "alcogas" put out by the United States Industrial Chemical Co., of Baltimore, this company being a subsidiary of the United States Industrial Alcohol Co. Each of these substitutes has its advantages and disadvantages.

Benzol is decidedly cheaper than gasoline in Europe, but on the other hand it is harder to start the engine with than with gasoline. Shale motor spirit of Scotland often runs 60 percent unsaturated and, accordingly, it is strongly odored, somewhat colored and cannot be stored for any considerable time without loss of quality. The alcohol products of Cuba and Natal, particularly when mixed with ether, as in the case of Natalite, give trouble owing to their great tendency to make the engine "knock" and also some trouble due to the difficulty of obtaining them free from acetic acid. If acetic acid is present there will be corrosion of the storage tanks, tank cars and the container tanks in the automobile. This corrosion and also the "knock" effect can be reduced and even avoided entirely by adding such material as aniline, but aliline is expensive. One does not want to add any considerable amount of a constituent costing $1.50 to $2 a gallon, and aniline cannot be had for less.

The "alcogas" is a more complex material than the substitutes used in other countries. It consists approximately of one-third benzol distillate, principally benzol and toluol, a second third of alcohol products, alcohol and ether, and the remaining third of petroleum distillate, principally gasoline. The amount of ether required to easily start the engine carries according to the time of year. In winter 10 percent, and in summer 3 percent is all that is essential.

(To Be Concluded)

The Perpetual Inventory

The perpetual inventory, or stores control systems, is strongly urged by the fabricated production department of the Chamber of Commerce of the United States as a better method in manufacturing establishments than the annual physical inventory, with its general disorganization and shutting down of the plant.

A practical pamphlet on the subject, which has just been issued under the title of "Perpetual Inventory or Stores Control," goes at length into the advantages of perpetual inventory and carries a series of illustrative forms. Doing away with the annual inventory of materials is only one of a number of benefits derived from the system as set forth by the department.

"The perpetual inventory test is an important link in a chain that makes less frequently necessary the burdensome and often inaccurate annual physical inventory. The annual physical inventory entails a general dislocation of plant and frequently a shut down lasting as long as three to seven days; and the results are not dependable. Hence the desirability of eliminating the annual physical inventory as far as possible.

"This is accomplished by independent checking of the material indicated as on hand on the perpetual inventory and bin tag records through a physical count of selected items of stores, and noting and correcting any discrepancies between stock actually on hand and the quantity shown by the bin tag and perpetual inventory records. These inventory tests are made periodically and systematically, preferably at times when the material selected is lowest, and the attempt is made to cover each item of supply at least once a year and important items oftener. It is possible by these tests, as supplementary to the bin tag and perpetual inventory records, to secure an accurate count of material without the burdensome annual inventory."

Copies of the pamphlet may be had in limited quantities free of charge from the Chamber of Commerce of the United States, Mills building, Washington, D. C.

One Motor to Every 18 in Canada

There are slightly under 9,000,000 people in Canada. There are approximately 500,000 motor vehicles. This means one motor vehicle to every 18 inhabitants. The report of the dominion government bureau of statistics shows that in the last year over 60,000 new motor vehicles have been licensed.

"The most surprising increase," said a provincial government official, "occurred in the western provinces. Saskatchewan which but a comparatively short time ago was a playground for the buffalo, today has 62,958 motor vehicles, mostly automobiles. Manitoba has 40,430, Alberta 38,750 and British Columbia 31,000.

"Western Canada's automobiles are not all pleasure cars. On the contrary thousands are used for the quick transportation of farm produce to markets. In the principal producing seasons nearly every car, big and small, is equipped with trailers for the movement of grain, fruit, livestock and dairy products. The western provinces are being settled by small farmers who are pouring into the fertile region along the transcontinental lines of the Canadian National Railways. They are going in for mixed farming. Dairying is favored because of the quick certain returns. Good roads and the automobile have almost eliminated distance, and they have solved the small farmer's problem of moving produce to market.

"Prosperity of western farmers in recent years has resulted in the increased use of all kinds of cars. Canada is taking advantage of this growing demand. Automobile production in Canada, according to the latest computation, was valued at $137,420,351 in 1920, an increase of $37,000,000 in 12 months. Investment in the industry is placed at $53,906,506."

Auto Market Glutted in United Kingdom

The market for motor trucks in the United Kingdom is decidedly unfavorable, the most important factor contributing to this condition in England being the oversupply on account of the surplus army stocks at Slough in Berkshire and the policy of the government in realizing on these supplies on the deferred payment basis. Agents of motor truck manufacturers state that at present they are utterly unable to move their stocks because of the far more advantageous price and credit terms being offered by the government, which is selling reconditioned trucks with a six-month guarantee, as low as £50, whereas local dealers have had stocks on hand for over a year, which they offer at £700 to £800.

The market in Scotland is depressed as a result of the general stagnation in trade and industry, and until the hoped for revival is apparent, the prospects for the sale of motor trucks are not encouraging. In this section of the country the demand will be chiefly for the heavier types, although the light delivery wagons are enjoying increasing popularity."

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, of THE AUTOMOTIVE MANUFACTURER, published monthly at New York, N. Y., for April 1, 1922.

State of New York,
County of New York, ss.

Before me, a Notary Public in and for the state and county aforesaid, personally appeared G. A. Tanner, who, having been duly sworn according to law, deposes and says that he is the Business Manager of The Automotive Manufacturer, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher: Trade News Publishing Co., 153 Waverly Place, New York City.
Editor: Morris A. Hall, 153 Waverly Place, New York City.
Managing Editor: Morris A. Hall, 153 Waverly Place, New York City.
Business Manager: G. A. Tanner, 153 Waverly Place, New York City.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Trade News Publishing Co., 153 Waverly Place, New York City.
G. A. Tanner, 153 Waverly Place, New York City.
Paul Morse Richards, 153 Waverly Place, New York City.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

G. A. TANNER, Business Manager.

Sworn to and subscribed before me this 31st day of March, 1922.
(SEAL) JOSEPH R. FRITH,
Notary Public, Kings County, No. 114.
Certificate Filed in New York County No. 260.
Kings County Register's No. 4116.
New York County Register's No. 4231.
Commission Expires March 30, 1924.

Analysis of Glue

The following is quoted from Chas. McKee, on the interpretation of glue analysis.

Viscosity and jelly strength have been discussed in the various texts and journals and are used as a main guide in determining the quality of the glue. By comparing standards or type samples with the one under investigation the relative grade can be determined. The oil viscosimeters on the market are not adapted to glue testing due to the shallowness of the well, lack of uniformity or orifice in different instruments of the same make, lack of provision to replace the orifice tips in case of injury or corrosion, and also poor means of release of the liquor which occurs in some types. As a result nearly every glue manufacturer has devised his own instruments for determining viscosity and jelly strength, resulting in instruments of various degrees of success and of individual standards.

The foam test is determined by stirring in some mechanical manner with the minimum loss of temperature, noting the volume and timing the duration of the foam. This has relation to the glue's behavior in mechanical spreading machines.

Keeping quality. Glue is a nitrogenous material which easily serves as a culture medium for bacteria. Liquefying cause of the personal education, skill required, influencing factors, or even absence of merit.

Joint test. Within reasonable limits all good grades of glue will give a glue joint stronger than the wood itself, providing that the joint has been carefully made. In other words the joint test will reflect the condition of the wood, the contact of the surfaces and the manipulation.

The success of many glue salesmen lies largely in their ability to understand the three above conditions, and if possible, supplying a glue to meet them.

The color and thickness of a flake of glue are of little value in determining the grade.

The fracture of a piece of glue is claimed to indicate quality but much experience is required to appreciate this. Moisture influences the fracture to a marked extent, so that little confidence can be placed on this test.

The shape of the pieces of glue is no measure of its value. For example, "noodle glue" has no special merit.

Streak. Some consider glue good when it forms a white streak on bending; it is needless to say that almost any glue will streak if it has enough moisture.

Finger test (jelly). Perhaps the test that the glue maker takes the most personal pride in is his ability to tell the quality by the feel and firmness of a congealed sample. In fact, by continuous practice he does develop skill in judging but has no method of expressing the value in units.

Glass chipping. The novice in this art will have a difficult time duplicating results as this work requires skill and standard conditions of drying. This test indicates nothing excepting that the glue is adapted to chipping glass.

Film test. The casting of sheets on glass, stripping and drying is apt to lead to erroneous conclusions unless all factors of temperature, thickness, stirring, rate of drying and humidity are constant.

Brush test. Pigment on dye is mixed with glue liquor and the mixture is brushed out on paper. This is supposed to indicate the amount of grease present in the glue, as the globules of grease will prevent the color to adhere in spots. The extent of spotting will depend on the character of the grease present and the state of division of the particles. Some glues are so greasy that the dry particles adhere together, yet they will not spot the paper. However this test is of value to makers of some types of cold water paints.—Chem. Bulletin.

Body Standardization

At a meeting of the Passenger Car Body Division of the Society of Automotive Engineers Standard Committee recently it was reported that investigation showed that a center-to-center distance of 1½ in. between escutcheon plate screws was very common. As the standardization of door handle square bearing diameters was suggested, it was decided to continue the investigation. The subject was assigned for further consideration to G. F. Goddard, who will make an investigation covering escutcheon plates, door handle square bearings and the bevel on door lock bars and escutcheon plate screw sizes.

Discussion of door hinges indicated that it may be possible to standardize some features of exposed hinges, the following dimensions being submitted as desirable practice.

Type	Plate Width in.	Thickness in.	Screws No.	Screws Size
Malleable or Forged	1¾	3/16	4	No. 10
	2	1/4	4	No. 12
Pressed	2	1/8	4	No. 12

Clearance between plates shall be 1/16 in. at the exposed end, tapering to ⅛ in. at the concealed end when hinges are closed.

As it was advocated that hinge pin diameters, hinge offsets and possibly hinge projections be standardized, it was decided to give this subject further consideration. E. G. Simpson was appointed to secure the necessary data and prepare a tentative recommendation.

O. H. Clark, who was appointed to formulate a recommendation on top irons in Feb., 1921, recently submitted a tentative report.

This report is based on a survey of present-day top iron practice, which showed a great variety of types and sizes. A careful analysis of the data, however, indicated that the great majority of top irons are made with 7/16-in-14 United States form threads. This thread has therefore been specified and should meet with general approval. The top iron types recommended cover all general requirements. The through-the-rail type of front top iron can be used through the rail by body builders who do not wish to provide for the removal of the top iron in case the permanent or California type of top is used. This type of top iron is superior to the separate through-the-rail type of front and rear top irons inasmuch as it is not necessary to counterbore such large holes through the rail for the top iron sockets, avoiding the weakening of the top rail.

This report was discussed at the last passenger car body division meeting, but no definite action was taken. It was felt that probably only the threaded shank on the top iron can be standardized, as there are so many varying conditions that control the other dimensions and shapes, and as no one top iron can be used interchangeably on different bodies or cars.

It was suggested at the last meeting of the passenger car body division that a standard should be formulated for the shanks on windshield side arms, so that body builders can provide standard holes in the body frames.

It was thought that the shank diameters should be in odd-number sizes and holes in even-number sizes, and there should be a definite series of lengths and threaded ends.

The society is to circularize the windshield manufacturers for suggestions and data in this connection before further action is taken.

It has been requested that the truck division standardize the mounting dimensions for motor truck cabs so as to permit interchangeability. This matter has been referred to the members of the truck division. If it should be the general opinion of the division that this subject should be taken up, a subdivision will be apopinted to formulate a tentative recommendation.

The Selection of Steels for Automobiles

(Continued from Page 21)

Steel (b) costs a little more than steel (a) but is a little stronger at high temperatures and so resists warping better.

Steel (c) is the strongest steel of the group at high temperatures, 1,200 to 1,700 deg. Fahr. and for this reason has the highest resistance to warping.

Steel (d) is not as strong at high heats as (c) but resists scaling much better. For this reason (d) under most conditions is better than (c).

TABLE 5

	(a) Percent	(b) Percent	(c) Percent	(d) Percent	(e) Percent	(f) Percent
Carbon—	0.25—0.35	0.50—0.70	0.50—0.70	0.20—0.40 or 0.40—0.50	0.40—0.50	1.20—1.50
Manganese—	0.50—0.80	0.30 max	0.30 max	0.050 max	0.30 max	0.20—0.30
Sulphur—	0.045 max	0.035 max	0.350 max	0.035 max	0.030 max	0.035 max
Phosphorus—	0.040	0.035 max	0.035 max	0.035 max	0.030 max	0.035 max
Silicon—	....	....	....	....	3.50—4.50	0.40—0.60
Chromium—	....	0.50—1.00	3.00—4.00	11.50-14.00	8.00-10.00	11.50-13.00
Nickel—	3.25—3.75	....	....	3.00 max	....	0.40—0.60
Tungsten—	....	1.50—2.00	13.00—15.00	....	....	....
Cobalt—	....	....	....	....	....	3.00—3.50

Steel (e) resists scaling a little better than (d) but is otherwise about the same.

Steel (f) resists scaling as well as (d) and is nearly as strong as (c) at high temperatures. It is about the best valve steel we have today which has been used on a production scale.

These 12 steels cover every need of the automobile engineer in designing a motor car. It has been necessary to be extremely brief in discussing each of these steels in order to cover them all. If a manufacturer makes every part of his automobile at his own plant, he will require a minimum of 12 steels, and if he uses cast iron head valves, he can cut down to 11. Under present conditions, this is the minimum number of steels from which an automobile can be built on a production scale. No manufacturer makes all parts for his automobile at his own plant, yet it is not at all uncommon to find 20 or more different steels in his stock. While it may not be possible for him to get down to a minimum of 12 steels, he should be able to get along with much less than 20. In these times of retrenchment and economy, it might be well for the manufacturer to consider the opportunity of large saving by reducing the number of steels in his stock.

Motor busses are being used by 32 electric railways in the eastern part of the United States, and motor busses with flanged wheels are being used by 28 short line steam railroads.

Favorable Auto Market in Australia

The overstock of motor cars in Australia, which six months ago was seriously depressing the market, has been entirely cleared up, and importations of American cars have greatly increased. Austria was the third largest purchaser of American cars during 1921, and her imports of motor cars from the United States were three times as great as those from the United Kingdom. Our shipments of cars to Australia numbered 3,740 in 1921 and 3,905 in 1920, a remarkable showing in the face of the adverse conditions prevailing during the first six months of the year, when the low conversion rate of Australian sterling, restrictions of remittances to foreign countries, and other factors were reducing all imports to a minimum.

The high initial cost and high cost of operation, together with the light roadbeds, have so far prevented any large use of motor trucks.

Trucks are used in fair numbers in Sydney, the undulating streets of which are hard on horses; but they are not used to any extent in the better paved streets of Melbourne, Adelaide, Brisbane, Perth, and other large cities, the initial cost proving the chief objection.

Every make of American car sells well in Australia, but in diminishing ratio as the price increases. Cars that are marketed in the United States from $700 to $2,400 are the most popular in Australia, where, under recent conditions of exchange, freight, and other charges, they retail at about twice the American price. Gasoline (all of which is imported), tires, and other supplies also cost about twice as much as in the United States; hence the car with low gas consumption and which is easy on tires makes a stronger appeal than a heavier machine. Some tires are now made in Australia, the local manufacturer supplying more than half the demand, but the price is high.

Resistance of Battery Separators

Measurements of separator resistance on a number of samples of different kinds of wood which were submitted by the manufacturers have been completed by the Bureau of Standards. A comparison of these results with those obtained on similar samples last May show excellent agreement and proves that the method for measuring the resistance is reliable. The soft woods, such as poplar and basswood, have the lowest resistance; cedar and cypress, on the other hand, have considerably higher resistance, but are known to have better lasting qualities when used in storage batteries.

In determining the durability of the separators in sulphuric acid solutions of different densities, a number of samples have been cut to a specified size and immersed in an acid solution of known concentration. One set is being kept at room temperature and a similar set at 45 deg. C. At the end of periods of one month, three months and six months samples will be withdrawn from the solution to determine the decrease in tensile strength of the separator material.

Automobile Body Builders' Association

The headquarters of the Automobile Body Builders' Association, which was formerly in the Monmouth building, has been removed to the Gotham National Bank building, 1819 Broadway, New York City, at Columbus Circle. This is the organization that sponsored the body builders' show in New York last January.

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

H. D. Church of Fairfield, Conn., formerly a chief engineer of the Packard Motor Car Co. and later vice president of engineering of Hare's Motors, Inc., is now at work in a consulting capacity on several interesting engineering developments. A medium weight six-cylinder model, embodying advanced features of design, was completely developed by Church as vice president of Hare's. It is understood his present activities include work upon another new light model. His services now are available as consulting engineer.

M. L. Pulcher, vice president and general manager of the Federal Motor Truck Co. has been named to head the National Association of Motor Truck Industries, plans for which were first formulated during the Chicago show and which came to fruition March 21, in Detroit, in the final organization of the new body. This association will have for its purpose solving transportation problems from the standpoint of the truck owner so that the industry may keep pace with the demands of traffic.

M. Charles Schweinert has resigned as president of A. Schrader's Sons, Inc., of Brooklyn, after a service of more than 35 years as general manager, treasurer, director and president. He has been retained by the corporation in an advisory capacity. Henry P. Kraft, vice president and treasurer, who has been associated with the Schrader company for the past 39 years, will succeed Schweinert as president.

Fred Hornby has been appointed superintendent of the final assembling division of the Rickenbacker Motor Co. He was engaged in similar work with the old E. M. F. Co., later joining the forces of the Maxwell Motor Co. in an executive production capacity and subsequently becoming research engineer for the Willys-Overland Co.

Walter C. Keys, for five years with the engineering department of the Cadillac Motor Car Co., and for the past five years prominent in the engineering end of the Standard Parts Co., has joined the forces of C. H. Foster, in the Gabriel Manufacturing Co., Cleveland. Keys will handle both sales and engineering ends of the Gabriel snubber business in Detroit.

E. L. Vail has reconsidered his resignation as head of the Waltham Watch automotive equipment division and has signed a contract covering a period of years as manager of the division. He will have immediate supervision over sales and service in that department.

H. J. Lount has been appointed comptroller of the Cadillac Motor Car Co. L. S. Carter took over Mr. Lount's former duties as head of the factory accounting department. Mr. Lount has been continuously with the company for 18 years as a payroll auditor.

S. A. Miles, automobile show manager, sailed from New York April 19 with Mrs. Miles for his annual trip to Europe. He will spend most of his time in England, but will also visit the continent to study prospects abroad for the sale of American cars.

Charles Morgana, formerly in charge of engineering and manufacturing for C. H. Wills & Co., Marysville, Mich., has severed his connection with that company to become general superintendent of the Maxwell Motor Co., Detroit, Mich.

A. Mitchell has been promoted to the post of manager of the New Orleans branch by the Martin-Parry Corp. This branch was scheduled to be opened about April 10, its territory to comprise all of Louisiana and most of Missippi.

Maurice Bleiweiss, whose four years in various executive capacities with the Templar Motors Co., Cleveland, have given him a thorough knowledge of the company's policies, has been made Templar sales manager.

William H. Alford, vice president Nash Motors Co., Kenosha, Wis., was elected one of five commissioners of the city of Kenosha, which has adopted the city manager plan of municipal government. Mr. Alford is one of three who will serve two-year terms.

R. W. Sutherland, former general manager of the Splitdorf Electric Co., has been elected vice president of the L. F. Benton Co., which manufactures screw machine products at Vergennes, Vt.

Frank H. Joyce has resigned as vice president of the American Auto Trim Co., Detroit. Joyce was one of the organizers of that concern with which he has been associated for many years.

Frank E. Smith, president of the Republic Motor Truck Co., has been added to the membership committee of the motor truck committee of the National Automobile Chamber of Commerce.

J. J. Cole, president of the Cole Motor Car Co., of Indianapolis, has returned from an extended pleasure trip to Europe where he visited most of the large cities.

G. W. Bunker was elected treasurer of the Multibestos Co., Walpole, Mass., at the annual meeting of the stockholders.

H. O. Swanson has resigned as chief engineer of the Fox Motor Co. of Philadelphia.

Body Builders

Martin-Parry Corp. has closed a lease with the New Orleans Metal Bed Co., whereby it comes into possession of 10,000 sq. ft. of floor space which it will use as a branch for its products, covering Louisiana and most of Mississippi. This is the fourth distributing center to be established in the south by the body builders, the others being at Atlanta, Houston and Dallas. A. Mitchell is manager of the New Orleans branch.

Hackney Brothers, Wilson, N. C., manufacturers of commercial bodies for automobiles, have awarded contract to the Wilkins & Wilkins Co., Wilson, for a new one-story plant, 80 x 300 ft. J. T. Hackney is general manager. The structure will replace works recently destroyed by fire with loss of about $110,000.

Lincoln Motor Body Co., Toronto, O., has been formed with a capital stock of $50,000 to manufacture motor bus bodies, cabs, trailers, etc. It will be under the management of Arnold Davis.

Missouri Car Co. of St. Louis has purchased a 10-acre tract in East St. Louis to manufacture steel car equipment and to build bus and commercial vehicle bodies to specification.

Fisher Body Corp. has declared the regular quarterly dividend of $2.50 on the common and 1¾ percent on the preferred stocks, both payable May 1 to stock of record April 21.

Cosmopolitan Body & Repair Co., 507 W. 35th street, New York, manufacturer of automobile bodies, etc., has leased the building at 136 W. 18th street for a new plant.

Hugh Lyons Co., Lansing, Mich., manufacturer of fixtures, automobile bodies, etc., is erecting a two-story steel manufacturing building, 60 x 240 ft.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

C. G. Spring Co. of Ohio has been organized by Christian Girl and will occupy a plant at 1830 E. 63rd street. Cleveland. This will be a finishing and assembling plant principally for the manufacture of automobile bumpers. The new company succeeds the Cleveland branch of the C. G. Spring Co., Kalamazoo, Mich., of which Mr. Girl is president. He is also president of the new Cleveland company. H. H. Burton is vice president and secretary, and A. E. Homan, sales manager and treasurer.

Pierce-Arrow Motor Car Co. and the **LaFayette Motors Co** merger was determined upon at a meeting of directors of both companies in New York Thursday, April 13. As a result of the change a new company is to be formed into which the two concerns will be consolidated. With the completion of the operation Charles W. Nash, head of the Nash Motors Co. and president of LaFayette Motors, will become chairman of the board in complete charge of the joint operating forces.

Richelieu Motor Corp., 649 Mattison avenue. Asbury Park, N. J., has been incorporated under Delaware laws with capital of $2,000,000 to erect a plant for the manufacture of automobiles. It has a tract of land on Ashbury avenue and has had plans drawn for a one and two-story plant, 80 x 200 ft., estimated to cost $200,000, including machinery. Samuel A. Reeves is president and Robert G. Poole, treasurer.

Studebaker Corp., South Bend, Ind., has plans under way for a new powerhouse at its automobile works, to cost about $750,000. It will also construct a storage and shipping building, provided with crate handling and conveying machinery, estimated to cost approximately $500,000. Production is being increased at the plant, and commencing in May closed type cars will be manufactured on a basis of 100 per day.

C. O. Miniger and other Toledo men have made an offer to purchase the plant and business of the Electric Auto-Lite Corp., Toledo, which is at present being operated by Mr. Miniger as receiver, as a result of the receivership of the Willys Corp., Elizabeth, N. J. The consummation of the sale is now awaiting the approval of the stockholders and the federal court.

Aluminum Die-Casting Corp., 87 35th street, Brooklyn, expects to start manufacturing die castings in Garwood, N. J., about May 1, having purchased the old C. & C. plant in Garwood which is being remodeled. The company is purchasing very little new equipment, as it expects to take over the business formerly conducted by the Acme Die Casting Corp., Brooklyn.

Saxon Motor Car Co. has started operations in the plant taken over from the Apex Motor Corp. at Ypsilanti. Harry L. Bill, vice president, is in charge of operations, with Carl H. Becker in charge of sales and D. C. Bayne, secretary and treasurer. The new plant affords 32,000 sq. ft. of floor space in a modern reinfo ced concrete structure.

Durant Motors of Canada, it is repo ted, will build an addition to the plant at Leaside, Toronto. the new buidling to be completed by early fall. When completed the entire plant will cover a site of 28 acres and will employ a force of 3,000 men, as compared with 600 at present. The capacity of the plant will be 50 cars per day.

Continental Products Co. has leased the plant of the Craig Tractor Co., Cleveland, and will expend about $20,000 in additions and alterations and will use it for the manufacture of automobile paints and varnishes. It is a steel building, 50 x 300 ft., occupying a six-acre site on Bliss road and the Nickle Plate railroad.

Domex Co., Buffalo, manufacturer of metal parts and specialties, has leased a building at Akron, N. Y., for the establishment of new works. A special department will be installed to manufacture automobile radiators and kindred products, heretofore made by the Kaman Auto Radiator Co., Akron. It is proposed to remove the Buffalo plant to the new location.

H. H. Franklin Mfg. Co., Syracuse, N. Y., has acquired local property for the erection of its new works to manufacture a light, four-cylinder, air-cooled automobile. The plant will have a maximum capacity of 100 automobiles per day. To provide funds, the company is disposing of an issue of $5,000,000 in preferred stock.

Sterling-Knight Motor Co. has acquired the manufacturing plant at Cleveland formerly occupied by the Accurate Machine Co., at Colt avenue and E. 134th street, at a consideration approximating a million dollars. Production plans are expected to be under way within as short a time.

Dort Motor Car Co., Flint, Mich., is disposing of a stock issue totaling about $1,500,000, the proceeds to be used in part for extensions and improvements in its plant. Effective May 1, an increased production schedule will be placed in effect, advancing from 1,500 cars monthly to 2,000 per month.

Pneumatic Disk Wheel Co. of Richmond, Va., has purchased the Wooster (O.) plant of the Kelley-Springfield Tire Co., the consideration being $150,000. The plant, which has been closed for some time, will be reopened July 1, and disk wheels for automobiles will be manufactured.

International Harvester Co., 216 N. 23rd street, Philadelphia, will build a five-story distributing plant, 100 x 130 ft., with one-story machine works and service building for farm tractors, motor trucks, etc., 100 x 140 ft., at 16th street and Indiana avenue, to cost $500,000, including equipment.

Corcoran-Victor Co., manufacturer of automobile lamps and accessories, has purchased property adjoining its plant on Colerain avenue, Cincinnati, with a view to taking care of future extensions. The premises for the present will be used for storage purposes.

H. B. Young Motor Truck Co., Geneva, O., has acquired the plant of the Simplicity Products Mfg. Co., Madison, O., and will move the equipment to the Geneva plant, which will engage in both the manufacture of trucks and power plant equipment.

Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y., has plans under way for a new building, 50 x 200 ft., at its branch plant, Sterling, Ill., estimated to cost about $50,000. It is also considering the erection of a new rod mill at this location.

Peters Motor Car Co., Bethlehem, Pa., recently removing from Trenton, N. J., and establishing an automobile manufacturing plant at Bethlehem, is arranging for the purchase of an adjoining site, comprising about 15 acres, for extensions.

Durant Motors Co. has placed an order for 100,000 motors with the Continental Motors Co., Muskegon, Mich. These motors will be used in a touring car to sell for $348, which will be manufactured at Lansing, Mich.

Chicago Wheel & Spring Co., 414 E. 34th street, Chicago, is receiving bids through an architect for a two-story plant, 50 x 50 ft., to cost $25,000.

Hartford (Conn.) Automotive Parts Co. assets will be sold as a going concern at auction, May 3.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

1068—An agency is desired by a merchant in Asia Minor for the sale of modern four-wheeled, rubber-tired carriages, one or two horse drawn, and extra supplies for same, such as rubber, leather, and oilcloth. Quotations should be given c. i. f. port of Asia Minor. Terms: Payment against documents at bank. Correspondence should be in French or Greek. References.

1070—The representation is desired by a mercantile firm in Palestine of American automobiles of the $1,000 to $2,000 class. References.

1074—A request has been received from an importing firm in Spain for the purchase and agency for leather goods and automobile accessories. Quotations should be given c. i. f. Spanish port. Correspondence should be in Spanish. References.

1086—A request has been received from a commercial agency firm in Spain for the purchase of general machinery and automobile accessories. An agency is also desired. Quotations should be given c. i. f. Spanish port. Correspondence is desired in Spanish or French. References.

1145—An inquiry has been received from a firm in Sweden which desires to purchase spare parts (not accessories) for all types of American automobiles. Quotations should be given c. i. f. Swedish ports. Reference.

1151—A firm of engineers in the United States, having connections with importers in Great Britain and France desires to secure the rerpesentation of firms manufacturing mechanical, electrical, and automobile specialties and patents. Reference.

1157—An electrical supply firm in Brazil desires to secure agencies for the sale on commission of electrical machinery and supplies, hardware, and automobile accessories. References.

1160—A mercantile firm in Australia desires to secure agencies from manufacturers for the sale of the best quality builders' and general hardware, aluminum ware, clothes wringers, lawn mowers, rasps and files, wire gauze, axles and springs, and general wooden ware for the coach builders' trade. Quotations should be given f. o. b. New York or other American port. References.

1167—A merchant in Austria desires to purchase dyed leather of every kind, especially leather for upholstering purposes; and to secure an agency for the sale of leather goods. Quotations should be given c. i. f. any German port. References.

1168—An industrial company in Guatemala desires to purchase tractors and cultivating machinery. Quotations should be given f. o. b. New York or New Orleans. Cash to be paid. Reference.

1191—A mercantile firm in Mexico desires to purchase automobile bodies, made in Detroit, for freight and passenger purposes; and also desires the exclusive agency for the sale of a good tire and inner tube. Quotations should be given f. o. b. factory. Terms: Cash with order. Reference.

1202—A commercial agent in Spain desires to purchase marine motors. An agency is also requested. Quotations should be given c. i. f. Spanish port. Reference.

1209—A commercial agency firm in Palestine desires to purchase and also secure an agency for automobile parts and accessories of all kinds. Quotations should be given c. i. f. Jaffa. Terms: Cash against documents. References.

1211—The owner of an automobile repair shop in Greece desires to secure an agency for the sale of a well-known competitive line of automobiles, 2, 3 and 4 seaters of 6, 8, and 12 horsepower. Quotations should be given c. i. f. Piraeus. To arrange cash payment against documents at port of shipment. Reference.

1220—A commercial agency firm in Spain wishes to purchase and also secure an agency for the sale of automobiles and accessories, garage machinery, electric motors, articles for the construction of chassis, electrical material for garage use, and lubricating oils and greases. Quotations requested c. i. f. Spanish port. Catalogs and correspondence should be in Spanish. References.

1248—An importer in Colombia desires to secure an exclusive agency for the sale of automobiles. No reference given.

1280—A merchant in Madeira desires to purchase and also to secure an agency for the sale of all kinds of motor car accessories, machinery, iron, steel, steel ceiling, tools, water pipes, steam pipes, rubber goods, tires, and inner tubings. Quotations should be given c. i. f. Madeira. Reference.

1281—The purchase is desired by a mercantile firm in Spain of automobile accessories. Quotations should be given c. i. f. Spanish port. Correspondence requested in Spanish. References.

1285—A mercantile firm in Spain desires to secure an agency for the sale of automobile accessories, hardware, lubricating oils and greases. Quotations should be given c. i. f. Spanish port or f. o. b. American port. Correspondence requested in Spanish. References.

1299a—1299s—Owing to the lack of space a number of "foreign trade opportunities" pertaining to automotive products have been grouped and can be obtained by referring to the opportunity numbers given.

1360—The owner and manager of a garage and repair shop in Spain desires to purchase and also to secure an agency for the sale of radiator mascots for automobiles, tire covers, vulcanizers, and equipment for repairing automobile tires. Quotations should be given c. i. f. Spanish port. Cash to be paid. Reference.

1379—A firm of automobile supply dealers in Ireland desires to secure an agency for the sale of a medium-priced automobile. Reference.

1380—A commercial agent in France wishes to purchase and also to secure an agency for the sale of automobile accessories. Quotations should be given c. i. f. Havre. Reference.

1382—Inquiries have been received from firms in Spain desiring to secure the representation of manufacturers of automobiles. Quotations should be given c. i. f. Spanish port, or f. o. b. New York. Correspondence requested in Spanish. References.

1392—An importing firm in Italy desires to purchase and also secure an agency for motor and upholstery leather, patent leather for shoes, and suede calf leather. Quotations should be given c. i. f. Genoa. Terms: Cash against documents. Reference.

The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1, Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3, Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. XLIV. No. 2 MAY, 1922 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3.

The Automotive Manufacturer

A Consolidation of The Hub and Automotive Engineering

Vol. XLIV. NEW YORK, MAY, 1922 No. 2

New Durant Small Car, Named Star, Indicates Big Value

Unusual Chassis Features, Coupled With Neat Up-to-the-Minute Bodies, and Supplemented by Remarkable Equipment, Make Strong Competitor for Ford

REMARKABLE in every respect, considering the price tag, is the new small Durant car, which has been named, perhaps aptly, the Star. Considering all that it offers the prospective purchaser, it might well be considered as a new star in the automotive firmament. During the winter, it was announced that Durant had practically perfected arrangements for the manufacture of a smaller job than the Durant Four, but at that time it was generally considered in the trade that this would be on the order of, and competition for, the Chevrolet 4-90.

When the car was actually announced, and later shown, it was discovered that it was more on the order of, and priced lower so as to compete with the Ford. A study of the characteristics of the car, as given herewith will show that it represents remarkable value, and the great crowds which have flocked to see it, as well as the tremendous number of orders which were placed for it, even before a single demonstration had been made or scheduled, showed that the public was quick to recognize this fact.

When first announced it was called simply a small four-cylinder, five-passenger car along conventional lines. The actual car is an assembled product, consisting of well and widely-known standard parts, inserted in a chassis which is remarkably like that of the Durant Four, only smaller. These standard parts, including as they do Continental motor, Timken bearings, Parish & Bingham frame, and semi-elliptic springs, vacuum feed gasoline tank, demountable rims, and full electrical equipment, emphasize

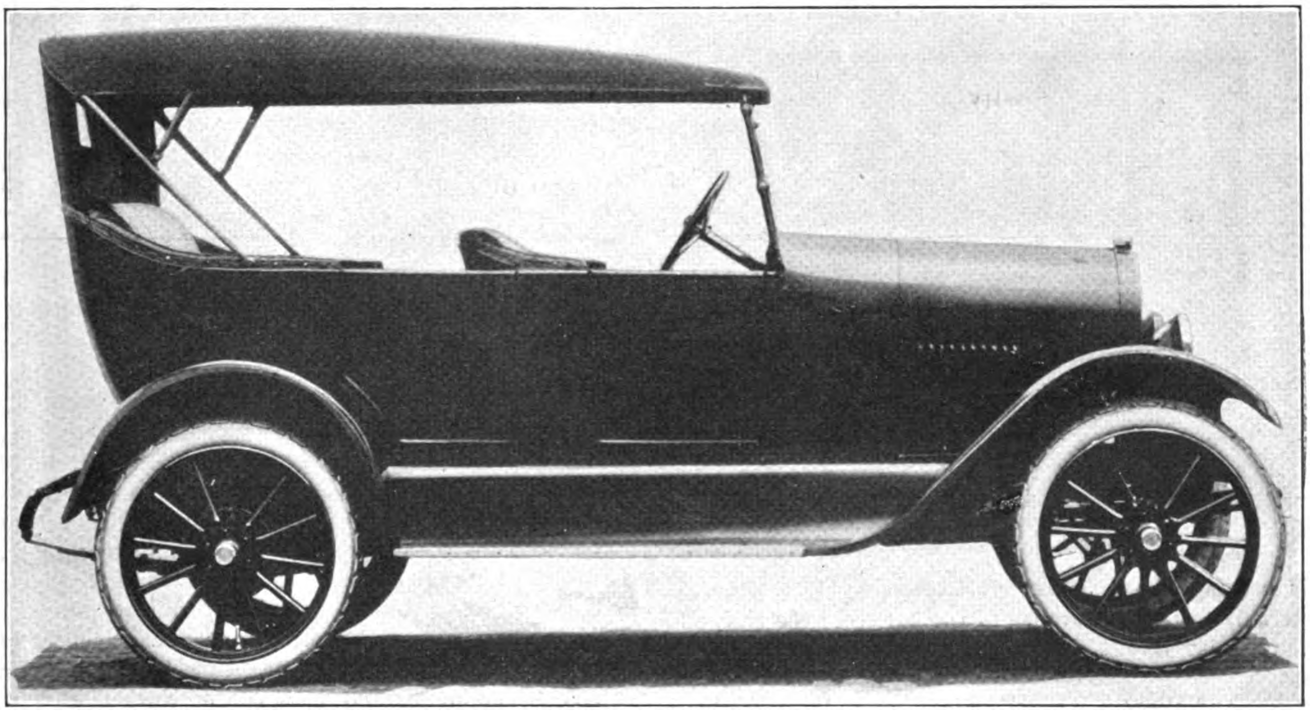


Fig. 1. Full side view of the new Star four-cylinder five-passenger touring car, which will sell at $348.

the valued offered. When shown in Washington for the first time, 27,000 people attended during the first day, and increasing numbers whenever shown elsewhere. In its first Saturday afternoon in Boston, at a showroom nearly three miles out from the center of the city, it attracted a crowd of nearly 4,000, and by Thursday night the total had risen to nearly ten times that number.

As stated, it is powered with a Red Seal Continental motor. It has a disc clutch, selective sliding gear with three speeds forward and reverse, and the power is transmitted to the rear axle through Hotchkiss type of driving shaft. Timken bearings are in use both front and rear, and the rear axle is of Timken manufacture. Brakes are of the internal and external type on the rear axle, the conventional hand lever operating one of these and a pedal the other.

The chassis frame is manufactured by Parish & Bingham, as stated, and is of the conventional type, except that it incorporates new tubular backbone, so called, an exclusive Durant feature. This is a large-diameter stout tube uniting the frame cross members in a fore and aft direction, and in this way imparting strength and rigidity

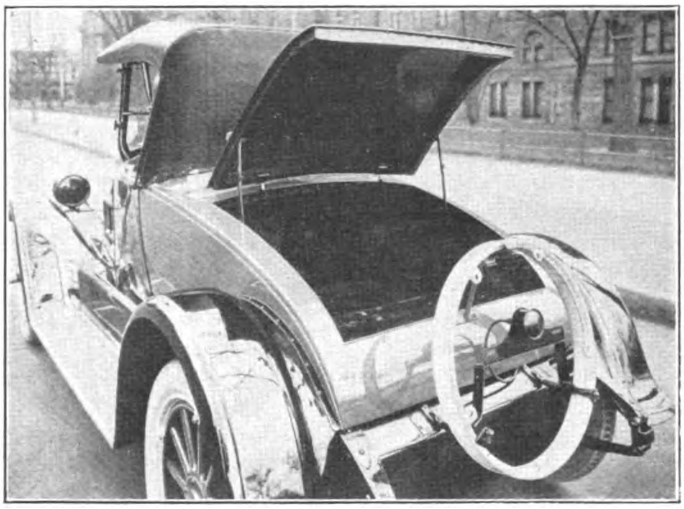


Fig. 2. Quartering rear view of the sport roadster recently added to the Star line of bodies. Rear compartment shown opened full.

to what might otherwise be a light frame. Being hollow, its interior is used as a muffler for the exhaust, thus serving a double purpose and also saving weight. The rear spring irons riveted to the frame ends can be seen in Fig. 2, herewith, in which will be noted also the fuel tank, the rear frame cross member which supports the tank, as well as spare rims.

The body is a full five-passenger capacity, with one-man top, and as Fig. 1 shows, has strictly modern lines. The steering wheel is given a considerable tilt, which adds materially to the appearance of the car from the side, and through placing the driver lower down, gives him more comfort. The hood line from radiator to windshield is straight and slightly inclined upwards and the windshield is set at a smart angle. In trimming the body, and throughout its equipment, very high grade units have been used, as will be noted in the lamp equipment, which can be seen in both views.

The tire equipment consists of four Fisk, non-skin tread, 31 x 4, straight sides, on demountable rims, with an extra rim at the rear, mounted on proper rim carriers.

Besides the regular body forms, a sport roadster has been announced as regular production, and this is shown in Fig. 2. This is a two-passenger model, with racy sweeping lines, and an unusual amount of leg room. The rear deck forms a storage compartment of remarkable size, practically its whole upper surface being hinged to lift upwards. This reveals a capacious interior, said to be large enough to hold two well-filled golf bags, a small trunk, and the usual amount of gear for a camping trip.

The top line of the body door blends off into the corner of this rear end and curves gracefully downward to the chassis frame, while the junction of the hood top line and vertical sides forms a similar graceful curve toward the front. This gives the full side view of this model a very beautiful appearance, quite above what one would expect in a car of this price.

The open touring car has been priced at $348, but the prices on the runabout, sedan sport roadster or other models, if any, have not been announced. The cars are to be manufactured in the various Durant plants in New York (Long Island City), Lansing, Mich., and Oakland, Cal., for the Star Motor Co. of New York, of Michigan and of California respectively. Plans laid down called for 100 sample cars in April, 500 in May, 1,000 in June, with production increasing beyond that point according to the public demand for the cars, and with due regard to the 1923 output totals. For next year, it is planned to turn out 200,000 or at rate of approximately 700 a working day.

The final sales plan will probably call for the establishment of division factory branches, which will have direct charge of sales in the territories which will include several states. These branches will appoint distributors and they in turn will appoint dealers. Each distributor will be required to name a large number of dealers who will agree to provide parts and service for the Star.

That no difficulty would be experienced in obtaining both direct sales and high-class dealers to handle the car was evidenced at the Boston display, mentioned previously. During that week, retail orders were received at the rate of one per minute, and dealer application at the rate of 100 a day. In addition, some 1,600 mail orders were forwarded to the New York headquarters. In the brief showing at Washington, more than 1,000 retail orders were placed. In fact, it has gone over so big, that people in the trade are predicting that a production of half a million in 1924 is not beyond the possibilities.

Artificial Wood from Refuse Materials

A recent invention of an artificial composition of interest to automobile body makers is reported from Australia. The material, which is similar to veneer, is produced from waste fibrous products and other vegetable matter, sawdust being used for the manufacture of cheap grades of the composition. It is claimed that it can be used for various purposes, including furniture veneers and wall panelling, and can be made to produce excellent marbling effects. It is capable of being bent easily for a variety of commercial purposes, can be worked with tools, sawed, bored and planed as freely as wood and takes nails or screws readily.

Eliminate 33 x 4 1/2 Rim

Motor truck rims 33 x 4½ inches in size have been taken off the standard list of sizes for original equipment by the Tire & Rim Association, Cleveland, O. The rim experts have substituted for it, for motor truck use, the 31 x 4 inch straight-side rim.

State Regulation of Motor Common Carriers

Preliminary Report Showing State Laws in Force in 1922, and Bills Pending Before State Legislatures—General Tendencies in State Control

PERHAPS the motor bus, perhaps the jitney, its predecessor, is responsible, possible neither one is the real cause, but at any rate there is now going on a great deal of regulating of motor vehicles, and talk of further regulating. The lawmakers seem much concerned over automotive vehicles in general, and busses or others carrying passengers for hire, and hence coming under the classification of common carriers, and many laws are being passed, or have been passed recently to restrict them in one way or another.

Furthermore, in some sections of the country, there have been and still are, large-scale attempts to boycott or otherwise restrict the legitimate bus or truck owner, who has cut too deeply into the railroad business, and thus indirectly into the source of livelihood of the railroad employees. These matters give much point to the careful report which has just been issued by the secretary of the Motor Vehicle Conference Committee. This report begins by stating that all motor vehicles are subjected to two general but distinct uses: First, they are privately employed by their owners for the transportation of persons or property; second, for the transportation for hire of the persons or property of others than the owners.

The second general use, continues the report, is subdivided into two definite and particular uses. In the first place, motor vehicles operating for hire are employed to carry certain persons or the property of certain persons to places prescribed in individual agreements entered into for the purpose; in the second place they are employed to carry indiscriminately all persons or the property of all persons under general conditions of agreement applicable to the whole public.

In a word, the second general use of motor vehicles, i. e. for hire, splits into that of private carriers and common carriers.

Until a few years ago the legislatures of our 48 states in no way differentiated between these various uses of the motor vehicle in the laws which they enacted dealing with operating requirements, registration fees and the many other subjects which are usually found in a state's motor vehicle laws.

In 1914, however, Pennsylvania definitely segregated motor vehicles when used as common carriers and placed them under the regulation of the state's public service commission. Today the laws of 22 states provide for a greater or less degree of such state control.

The Character of State Control

On pages — and — is a tabulation setting forth a digest of the more important matters which through the year 1921 had been made the subject of those state laws specifically enacted to bring motor vehicle common carriers under state control and regulation. This tabulation should be carefully considered in connection with the following discussion of the data which it contains.

State Agency Exercising Control

Without exception state regulation of motor vehicle common carriers has been vested by law in pre-existing state agencies that exercise control over other forms of carriers such as railroads, trolleys, telephone and telegraph lines, pipe lines, etc. The third column of the tabulation on page 4 shows that these agencies have consisted of state public utilities or public service commissions, railroad commission, the commerce commission as in the case of Illinois, the state tax commission of Alabama, the Arizona corporation commission or even the state road commission as in West Virginia.

In some instances these pre-existing state agencies have assumed control over motor vehicle common carriers by virtue of the broad general powers of the laws establishing the commissions. The railroad commission of Georgia, for instance, maintains "that operators of motor vehicles, holding themselves out as carriers of passengers or freight, either or both, for hire, and operating over established routes, are subject to the jurisdiction of this commission. This commission has not, however, had occasion up to this time to exercise this jurisdiction." In certain other instances, however, where the laws have been specifically limited in their application or where their application to motor vehicle common carriers has been a matter of doubt, attempts on the part of the state agencies to extend their power over highway transportation have usually ended in the courts and in decisions adverse to the contemplated expansion of control.

Application of Control

In its broadest conception a motor vehicle common carrier is one that passes any and everywhere over the highways indiscriminately transporting for a consideration all persons who present themselves as passengers or carrying all commodities or classes of commodities offered. Obviously this involves interstate transportation. The federal interstate commerce act takes no specific cognizance of the matter, however, so the application of control by the various states is in no way guided or modified by federal laws on the subject.

A few states deal with the subject merely from the standpoint of local control, the incorporated municipalities being given power by the state legislature to require motor vehicle common carriers to obtain permission and a license for operating from the local governing body. This is the case in Massachusetts where the board of selectmen or city council exercise control over motor vehicle common carriers transporting passengers.

As for state control this expresses itself in two ways: On the one hand there is a state law whose provisions give to some state agency broad general powers of control over motor vehicle common carriers. On the other hand, for the execution of these powers, the agency is permitted to promulgate and enforce such rules and regulations as it may deem necessary, express stipulation being made in some of the state laws on the subject, that these rules and regulations shall take precedence over municipal ordinances.

The various laws establishing and defining this state control have in many cases, however, greatly narrowed its application. For instance, while most of the states which have dealt with the subject allow their respective state

agencies to regulate both passenger and property transportation by motor vehicle common carriers, Alabama, Connecticut, Maine, New Hampshire and others limit this power to passenger transportation only.

Then again, while most of the regulating states apply their powers of control to carriers operating within, into, and out from the limits of incorporated municipalities, California, Ohio and Oregon merely exercise authority over such transportation that is not confined solely to the limits of a city, town or other similar form of incorporated municipality.

As another and final illustration most state laws regulating motor vehicle common carriers narrow the scope of such control to vehicles operating "between fixed termini or over a regular route." In the Arizona law this expression is defined to mean the termini between which or the route over which a carrier usually or ordinarily operates his motor vehicle "even though there may be departures from said termini or route, whether such departures be periodic or irregular." As a rule it is made a question of fact for the state agency exercising control to determine if the carrier is operating "between fixed termini or over a regular route."

Powers of State Agency

With very few exceptions the powers wielded by the public service commissions or similar forms of state agencies over common carrier transportation by motor vehicles are extremely numerous and broad. A consultation of the chart shows that these powers can be listed as follows:

(1) Grant, refuse to grant, amend or revoke certificates of public convenience and necessity.

(2) Prescribe routes.

(3) Fix schedules.

(4) Determine character of service and promote the comfort and safety of traveling public.

(5) Establish fares and rates.

(6) Require reports and uniform methods of accounting.

(7) Examine accounts and records.

(8) Supervise fiscal affairs such as incorporation, capitalization of stock, etc.

(9) Compel additions to, extensions of or betterment in physical equipment.

It is apparent that these powers are practically unlimited and of such a nature that the state agency has almost absolute control over the life or death of motor transportation within its jurisdiction. Nevertheless all of the rulings of the various commissions are subject to review by the proper courts and aggrieved parties can easily and freely appeal for redress of wrongs or supposed wrongs.

Furthermore, in the all important matter of certificates of public convenience and necessity decisions are usually made contingent on public hearings at which applicants for such certificates, other agencies of transportation serving the same territory and the general public are given full opportunity to present facts and opinions on the subject.

Prerequisite of Operation

Up to this point in the discussion the entire subject has been approached from the standpoint of the state's power. It is now desirable to look at the question from the side of the operator of a motor vehicle common carrier, especially to learn what steps he must take in order, either to stay in business after a state adopts the policy of regulation or enter the business anew.

In a few states, as New Hampshire, for instance, it is only necessary for the operator to obtain a permit from the state authority. This is the rare exception, however, rather than the rule. In nearly every other state a certificate of public convenience and necessity is required; while in Colorado, New York and Wisconsin a permit from the governing bodies of the municipalities in which the common carrier seeks to operate must also be secured.

In several states motor vehicle common carriers established at the time the law first went into effect have been expressly exempted from this requirement making it necessary for none but operators beginning business after the passage of the law to obtain certificates of public convenience and necessity. In Connecticut, however, and in general in every other state, established, as well as new motor vehicle common carriers, have been obliged to demonstrate to the state agency their right to exist after the state control act has been written into the statute books. Obviously, this has very often meant real hardship to those who have invested substantial sums of money in motor vehicles and have built up paying businesses over certain routes only to be obliged to abandon everything under state regulations.

Another usual prerequisite to the operation of motor vehicle common carriers has been the necessity of taking out indemnity bonds for the payment of any claims that may arise from any injury caused to persons or damage done to property by the carrier. In general the conditions of these indemnity bonds and sometimes their amounts are left to the state agency to determine. Frequently, however, the amounts are fixed by law as in Washington where $5,000 to $10,000 is prescribed for indemnification of claims arising from injury to persons and $1,000 for damage to property.

Special or Extra Taxes

While in the imposition of annual registration fees and other forms of taxes upon motor vehicles, state legislatures have in only a few cases discriminated between motor vehicle common carriers and private carriers, nevertheless, they have drawn a sharp line between motor vehicles used privately by their owners and those operated for hire.

By way of illustration, in Maine a motor vehicle used for hire must pay twice the normal annual registration fee for the class of vehicles to which it belongs. No extra or sepcial charge, however, is made when this vehicle is engaged in the common rather than the private carrier business.

It will be noted from the seventh column of the tabulation on page —, that in practically every case where there is state regulation, this course is pursued and special and greater fees in lieu of the regular annual registration fees are imposed or else extra burdens are added to those usually imposed by the state on motor transportation.

General Observation

In connection with the foregoing discussion it is of interest to note that the laws of Colorado expressly authorize the municipalities of the state to acquire, own and operate motor vehicle common carriers, while in Connecticut the street railway lines are given this same power with respect to passenger-carrying motor vehicles.

Another point worth noting is that, while some states

have not gone so far as to place motor vehicle common carriers under the full regulation of a state agency of government, nevertheless, they have enacted laws with a measure of such control in view. To illustrate: In Louisiana a statute approved in 1918 defines a power-driven vehicle carrying passengers or freight for hire over the highways outside of incorporated municipalities as a "service car." Operators of service cars are obliged to procure from the police juries of the parishes in which they reside, certificates of their ability and skill to operate and furnish indemnity bonds against claims arising from injury to persons or damage to property.

A variation from the type of local control exemplified by Massachusetts is that which obtains in Delaware, where the Wilmington board of public utility commissioners has, with regard to motor vehicle common carriers transporting persons, prerogatives and exercises functions similar to those set forth in this report for the general form of state control.

As has already been observed, the power of the state agency exercising control is usually laid down in the law in general language which is generally so broad and comprehensive that it covers every possible phase of the motor vehicle common carrier business. This control then finds concrete expression in rules and regulations promulgated by the state agency from time to time as occasion warrants. For instance in Nebraska, the Nebraska state railway commission entered an order on May 21, 1919, that beginning July 1 of the same year, the motor vehicles holding themselves out to carry freight for hire in a certain portion of the state should establish, maintain and apply a prescribed schedule of rates on freight to be classified in accordance with so-called General Order No. 24. In no other portion of the state nor in any other particular did the commission assert its prerogatives. Furthermore, on April 20, 1921, it rescinded and annulled this order.

As an illustration of an entirely different tendency, in Washington state, where the law placing motor vehicle common carriers under control of the department of public works went into effect last year, General Order M. V. No. 1, issued June 9, 1921, provides a very elaborate set of "rules and regulations governing the transportation of persons and property for compensation over any public highway." These cover the procedure for obtaining a certificate of public convenience and necessity for a certain number of prescribed vehicles; what must be done for permission to operate more vehicles in case of emergency; the sale, transfer or mortgaging of certificates; passenger and freight tariffs; rates; free passes; schedules, including changes in or discontinuance thereof; liability and property damage insurance; obligatory equipment including necessity to carry extra tires, speedometers, heating system for passenger carrying vehicles, fire extinguishers, route signs, etc.; operating regulations including in addition to the requirements of the state motor vehicle law, provisions as to the character and conduct of drivers, taking on of passengers and seating thereof, baggage, comfort stations, etc.; fees additional to the state registration fees; annual reports, etc.

Arguments Pro and Con

Any discussion of state regulation of the motor vehicle when used as a common carrier would be incomplete without reference to the arguments for and against such regulation. In so doing, however, the opinion frequently expressed that railroad and trolley companies, as a result of the severe competition of motor transportation, are seeking state regulation as a means of killing off such competition, will be totally disregarded, and only such arguments recorded as are predicted on public welfare, sound economics and strict impartiality.

Arguments Pro

With these premises therefore those who contend for state regulation say that such control is necessary:

(1) Because motor transportation for hire is a public utility and as such should be regulated along with other public vehicles so that travellers and shippers by such means can be made sure of safe, prompt, regular, adequate, efficient and economical service.

(2) So that, in all cases where motor vehicle common carriers come, or are likely to come, in ruinous competition with other common carriers, the state can step in and determine whether public convenience and necessity require such competition, and save, if desirable, the pre-existing agencies of transportation.

(3) In order to should upon the motor vehicle common carrier obligations, financial and otherwise, in return for the rights given it to operate for a profit over all or certain highways within a state especially so since the highways are built and maintained by the public. In some cases these rights take the form of valuable franchises which virtually grant monopolistic privileges over certain routes.

(4) For the purpose of eliminating the irresponsible, so-called "fly-by-night" companies and individuals, who, while undergoing certain destruction for themselves, pull down with the ruin well managed motor transportation agencies which render a real public service and are entitled to a reasonable return on their investments and a stabilization of their business.

Arguments Con

In objection to these arguments for state regulation of the motor vehicle common carrier, opponents of the proposition maintain:

(1) That granted motor transportation for hire is a public utility, public interest can best be served by unrestricted competition and complete freedom from regulation in which none but the fittest can survive. This policy they contend will yield to passengers and shippers the maximum of results with the minimum of cost.

They deny any analogy between motor vehicle common carriers and railroad and trolley transportation agencies, pointing out that the latter by virtue of private ownership of franchises, rights of way, road beds, tracks and terminals have an exclusive and monopolistic control over all transportation on their routes. Motor truck operators, on the other hand, even where granted a monopoly of transportation for hire over a certain prescribed highway or portion thereof cannot deny the use of that highway to others who wish for themselves or as private carriers to transport persons or property over those same routes.

Finally, they point out that governmental regulation of rail and trolley common carriers came after these agencies had abused their rights and privileges and through pools, stifling of competitoin, exorbitant increase of rates, discrimination, stock watering, etc., made it necessary for the public in self-protection to subject them to control. By the very nature of the service these evils are impossible with motor transportation since the road is free to the use of everyone and motor vehicles the medium for

Summary of State Laws Regulating Motor Vehicle Common Carriers

State	Law in Effect	Application of Control	Prerequisites of Operation	General Powers of State Agency, Etc.	Special or Extra State Taxes
Alabama	1919**	Passenger transportation only. Within, out from and into municipalities.	Filing of written statement showing terminal points of routes to be covered. Obtaining of special license.	x	In lieu of regular registration fee, the following: Seating capacity 5 pass. or less .... $37.50; Seating capacity over 5 pass., less than 10 .... 60.00; Seating capacity over 10 pass. 90.00
Arizona	1919[1]	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by Commission.	General control over granting of Certificate of Public Convenience and Necessity; regulating service; fixing rates and fares.	x
Arkansas	x	x	x	x	x
California	1917[4]	Passenger and property transportation. Out from and into municipalities only.	Certificate of Public Convenience and Necessity.	Grant, refuse, suspend, revoke or amend Certificates of Public Convenience and Necessity; prescribe service or extensions thereof; fix rates and fares, supervise fiscal affairs; authorize sale or lease of certificates.	x
Colorado	1915[6]	Passenger and property transportation. Within, out from and into municipalities.	Permission from municipalities to operate. Certificate of Public Convenience and Necessity.	Wide control over issuance of Certificates of Public Convenience and Necessity; prescribe service or extensions thereof; fix rates and fares; promote health, safety and convenience of operation. Municipalities may purchase and operate motor vehicle common carriers.	Special registration fees for passengers carrying motor vehicle: Seating 9 passengers or less, $20; for each additional seat of capacity, $1.
Connecticut	1921[6]	Passenger transportation only. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity insurance based on seating capacity; range $5,000 to $10,000 per vehicle.	Grant or withhold Certificate of Public Convenience and Necessity. Street railroad company may acquire, own and operate motor vehicles for hire.	Extra registration fees as follows: Regular fees plus $15 for vehicle with seating capacity of 5 or less; over 5 but under 21, $2 per seat over 5; 21 but under 41, $5 per seat over 20; 41 or over, $10 per seat over 40.
Delaware	x	x	x	x	x
Florida	x	x	x	x	Special registration fees: For passenger carrying vehicle: seating capacity 7 or less, $5 per seat; over 7 but less than 17, $7.50 per seat; 17 or over, $10 per seat in addition to 75c per 100 lbs. gross weight of vehicle and load. For property carrying vehicles, $1.50 per 100 lbs. gross weight on pneumatic tires; $2.25 per 100 lbs. on solid tires.
Georgia	1907[4]	x	x	The Commission holds that it has jurisdiction over motor vehicle common carriers, but has not as yet had occasion to exercise this power.	Special registration fees for passenger carrying vehicles with a seating capacity of 10 or more, $75.
Idaho	x	x	x	x	x
Illinois	1921[2]	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Adequate indemnity insurance or sworn statement of ability to meet any possible damage claims.	Grant, refuse, alter, modify Certificates of Public Convenience and Necessity. Regulate rates, fares, service, contracts, practices, etc.	Extra state tax property carrying vehicles not operated exclusively within a municipality. Gross weight 12,000 lbs. or less, 1c per mile; over 12,000 lbs., 2c per mile. On passenger carrying vehicles gross weight 12,000 lbs. or less, 1/15c; over 12,000 but not more than 15,000 lbs. ⅛c; over 15,000 lbs., 1/6 c per mile.
Indiana	x	x	x	x	x
Iowa	x	x	x	x	x
Kansas	x	x	x	x	x
Kentucky	x	x	x	x	x
Louisiana*	x	x	x	x	x
Maine	1921[6]	Passenger transportation only. Within, out from and into municipalities.	Certificate of Permission.	Make rules and regulations governing operation; fix fares, regulate routes and schedules, etc.	Extra State Registration fee amounting to double normal fee.
Maryland*	1916[5]	Passenger and property transportation. Within, out from and into municipalities.	Annual permit.	Grant or refuse permits. Make rules and regulations governing operation. Fix rates, fares, schedules, etc. Provide for safety and convenience of traveling and shipping public.	x
Massachusetts	x	x	x	x	x
Michigan	x	x	x	x	x
Minnesota	x	x	x	x	25% extra registration fee for property carrying motor vehicles and passenger carrying motor vehicles seating more than seven passengers.
Mississippi	x	x	x	x	x
Missouri	x	x	x	x	x
Montana	x	x	x	x	x
Nebraska	1919[4]	Commission has only asserted jurisdiction over property transportation out from and into municipalities.	x	Commission in 1919 issued an order affecting rates and classifications of property carried by motor vehicle common carriers out from and into municipalities. Order rescinded in 1921.	x

Nevada	1919[5]	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity bond not less than $500 nor more than $10,000 per vehicle.	Issued or without Certificate of Public Convenience and Necessity. Regulate fares, rates, schedules, classifications. Examine books and records; prescribe service; order improvements, additions, etc.	Extra annual tax of $2 per 100 pounds gross weight for operating on first class highways. $1 per 100 pounds on second class; 25c per 100 pounds on other than 1st and 2nd class.
New Hampshire	1919[5]	Passenger transportation only. Within, out from and into municipalities.	Permit to operate. Indemnity bond $500 per vehicle plus $100 per person, of seating capa'ty.	Grant or refuse permits. Establish reasonable rules and regulations governing operation.	x
New Jersey	1921[6]	Passenger transportation only and solely where it parallels street railway lines. Within, out from and into municipalities. Only applicable to lines established after March 15, 1921.	Indemnity bond of $5,000 by municipalities in which lines operate.	General supervision, regulation and jurisdiction in the matter of rates, fares, schedules, service, etc.	Special registration fees as follows: 5 passenger or less, $15; 6 to 8 persons, $17.50; 9 to 12 passengers, $20; 13 to 17 passengers, $25; 18 to 22 passengers, $30; 23 to 26 passengers, $35; 27 to 30 passengers, $40; over 30 passengers, $40; plus $2 per seat in excess of 30.
New Mexico	x	x	x	x	x
New York	1915[5]	Passenger transportation only. Within, out from and into municipalities.	Consent of municipal authorities. Certificate of Public Convenience and Necessity. Indemnity bond as conditioned by the local authorities.	General jurisdiction over rates, fares, schedules, service, etc.	Special registration fees as follows: 5 passengers or less, $15; 6-7 passengers, $24.50; 8-10 passengers, $30.50; 11-16 passengers, $43; 17-20 passengers, $52; 21-22 passengers, $55; 23-26 passengers, $61.50; 27-30 passengers, $67.50; over 30 passengers, $67.50, plus $2 per passenger over 30. Schedule not applicable to omnibus operating wholly within municipality under franchise granted by said municipality.
North Carolina	x	x	x	x	Extra registration fee of 50% over normal fee.
North Dakota	1919[4]	Passenger and property transportation. Within, out from and into municipalities.	x	Fix and adjust rates, fares, classifications, schedules, etc. Establish uniform accounts. Investigate books, records, methods, etc.	Extra registration fee for passenger carrying vehicles, 25c per passenger of seating capacity allowing 16 inches of seating space per passenger.
Ohio	1921[5]	Passenger transportation only. Out from and into municipalities only.	x	Fix fares; exercise general supervision over the operation of the carrier, regulate general relationship between carrier and public.	x
Oklahoma	x	x	x	x	x
Oregon	1920[5]	Passenger and property transportation. Out from and into municipalities only.	Certificate setting forth special terms and conditions under which operation is permitted. Indemnity bonds as conditioned by the Commission.	Supervisory and regulatory powers on all matters affecting the relationship of carriers with passengers and shippers. Fix reasonable rates, fares, charges, service, facilities, etc. Supervise and regulate accounts; require reports, data, etc.	For passenger carriers extra registration fee of $4 per passenger allowing 20 in. for seating space per passenger. For property carriers extra registration fee of 50c per inch of total tire width. In addition for both passenger and property carriers an annual fee for administration of motor vehicle common carrier laws of not more than $10 per vehicle.
Pennsylvania	1914[5]	Passenger and property transportation. Within, out from and into municipalities only.	Certificate of Public Convenience and Necessity.	Grant or refuse Certificates of Public Convenience and Necessity. Regulate rates, fares, schedules, equipment, service, etc. Examine accounts and records. Require reports, uniform accounting methods, etc.	x
Rhode Island	x	x	x	x	Extra registration fee of 100% over normal fee.
South Carolina	x	x	x	x	x
South Dakota	x	x	x	x	x
Tennessee	x	x	x	x	x
Texas	x	x	x	x	x
Utah*	1918[6]	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity.	General Supervision and regulation. Fix rates, fares, tolls, rentals, charges and classifications; regulate practices, facilities and methods. Establish uniform accounting; make investigations; require reports, etc.	x
Vermont	x	x	x	x	x
Virginia	x	x	x	x	Extra annual tax of $5 per vehicle in cities and towns of less than 5,000 population; $10 per vehicle where population is 5,000 or over.
Washington	1921[3]	Passenger and property transportation. Within, out from and into municipalities.	Certificate of Public Convenience and Necessity. Indemnity bond $5,000 to $10,000 per vehicle for injury to persons; not over $1,000 for damage to property.	Grant, refuse, suspend, revoke, alter, amend Certificate of Public Convenience and Necessity; fix proper rates, fares, charges, classifications, regulations. Prescribe equipment, service and safety of operation. Regulate accounts; require reports, etc.	Extra annual registration fees: Passenger carriers for vehicles with seating capacity of 8 or less, $10; 50c per passenger over 8. For property carriers, $10 for vehicle of 3 tons or less capacity; $1 per ton of capacity over 3 tons.
West Virginia	1921[4]	Passenger and property transportation. Within, out from and into municipalities.	Permit to operate.	Grant permits although no discretionary power is vested in Commission. Classify vehicles and fix their privilege taxes.	For passenger carriers extra registration fee roughly 100% greater than normal annual fees.
Wisconsin	1915[4]	Passenger transportation only. Within, out from and into municipalities.	Consent of Municipal Indemnity bonds as fixed and approved by the Commission.	Determine adequacy and reasonableness of fares, routes and service. District Attorney authorized to enforce rules laid down by Commission.	Special fee for passenger carriers operating wholly within a municipality, $10 per vehicle, which is in lieu of regular fee.
Wyoming	x	x	x	x	x

1 Corporation Commission controls.
2 Commerce Commission controls.
3 Dept. of Public Works controls.
4 Railroad Commission controls.
5 Public Service Commission controls.
6 Public Utilities Commission controls.

** State Tax Commission controls.
* Since these tables were made up the following information under "Special or Extra State Taxes" has come in:

MARYLAND
Special fee, $1.20 per h.p.

TEXAS
Carrying persons or property for hire between municipalities, $32 to $160, plus ½c to 4c per mile traveled according to net carrying capacity.

LOUISIANA
Special registration fee for passenger carriers; 68c per h.p., plus $2 per passenger up to 8; $3 per passenger, 8-25; $5 per passenger over 25.

transportation over the roads are quickly, cheaply and in unlimited numbers available for everyone.

(2) Since the obvious outcome of the first argument advanced against state regulation is "cut-throat" competition between various forms of transporation attempting to serve a certain territory and per se between the motor transporation companies themselves operating in competition over certain highway routes, the opponents of state regulation cannot escape the query whether they are willing to face the logical consequence of such a struggle. Without hesitation they answer that wherever rail, trolley or any other form of transportation for hire cannot stand up before a newer and better form, public interest demands that it should give way; likewise within that newer and better form of transportation, the rule should be survival of none but the most efficient and economical agencies. They are confident that even though such a policy may mean the destruction at times of more or less invested capital, as it did when rail and inland water transporation first came into acute competition, the final economic benefits to the community as a whole will many times compensate for the loss involved.

(3) As for shouldering upon motor transportation for hire financial and other burdens which it should rightly carry, opponents of state regulation say that legislative bodies have not heretofore found it necessary to establish such control in order to determine the weight limits for motor vehicles used as common carriers; their registration fees and other charges; their liability to the public for injury to persons or damage to property, etc. If this is all that is involved it is not sufficient to warrant almost unlimited regulation in all other respects by a state agency.

(4) Lastly those against state regulation believe that the natural working out of economic laws will do more to stabilize the motor transportation for hire business than extensive interference on the part of governmental agencies of any sort. They feel that the proposition is paternalistic and will result either in discrimination in favor of one or more types of transportation, and against all the rest, or else that it will promote monopolistic advantages for certain motor transportation companies and that through it all the traveling and shipping public will pay the cost.

Russia Lifts Ban on Car Imports

Right of private ownership of automobiles in Russia has been restored by the council of commissars. It is also disclosed through dispatches from that country that the importation of automobiles, motorcycles, bicycles and their accessories will be permitted through the foreign trade commissariat. As a result of these developments it is understood that certain American agencies have placed orders with the supreme economic council, in preparation for expected developments at the Genoa economic conference.

The annual meeting of the National Highway Traffic Association will be held on May 12 at the Automobile Club of America, New York. Among the subjects listed for discussion at this meeting are traffic safety, regulations governing speeds, weights and dimensions of motor trucks and trailers, license fees and highway franchises.

Left-Hand Drive on Cars in Great Britain

Although there is a good deal to say against the system of the left-hand drive on cars used in Great Britain, the advisory committee on motor car transporation does not see its way clear to recommend its prohibition in the country, according to the Autocar of March 4, and there does not seem to be any intention of such a law being enacted.

While in the United States and on the continent, where the traffic rules are the opposite of those in Great Britain, the left-hand drive is generally adopted, British motorists using cars equipped with right-hand drive are not experiencing any great difficulty and are not said to be exceptionally dangerous users of the roads. It seems that the danger of left-hand driving has been exaggerated and that the propaganda against it proceeded from other motives than those of public safety.

The advisory committee, however, will make certain recommendations for the prevention of accidents, among which will be included a ruling to the effect that if the position of the driving wheel is such that the driver can not give a hand signal to other drivers, some mechanical signaling device must be provided which can be easily worked by the driver. The report of the committee, which is the outcome of long deliberation, will shortly be issued and its recommendations along the lines indicated will probably be adopted by the ministry of transport.

American Cars Lead in South Africa

American cars sell cheaper than those of British make in South Africa, but increased propaganda on the part of British manufacturers may do much to offset this advantage, in the opinion of the Bloemfontein correspondent of the London Times Trade Supplement. The writer brings out the following points:

South Africa's chief source of automotive products in 1913 was Great Britain, with a total of £460,797, compared to those from the United States totaling £389,057. In 1920 the United States furnished £2,952,985 worth of motors and spares, as compared with £427,441 from Great Britain. The returns for 1921 are not yet complete, but the same proportion prevailed, although the quantities were much smaller. Taking the above figures as a basis, the normal market is estimated as being capable of taking 600 cars per month in the future.

A comparative price table, eliminating the cheaper cars and the higher-priced cars and with the prices of British makes estimated, shows that on the average American cars sell from £275 to £140 cheaper than the British makes of the same class. The American dealers score heavily on propaganda as well as price, while the Britisher has done little, if anything, along that line. However, the British manufacturer does enjoy many advantages, namely: A 3 percent preferential tariff in South Africa; a sentimental preference equal to at least 10 percent; an advantage in the balance of exchange amounting to about 10 or 12 percent; and the advantage of lower freight rates due to proximity of the market as compared with the United States.

Smart Young Man—What do you think of Brown?

Indignant Old Gentleman—Brown, sir! He is one of those people that pat you on the back before your face, and hit you in the eye behind your back!

Pipe Body Simple to Build and Very Useful

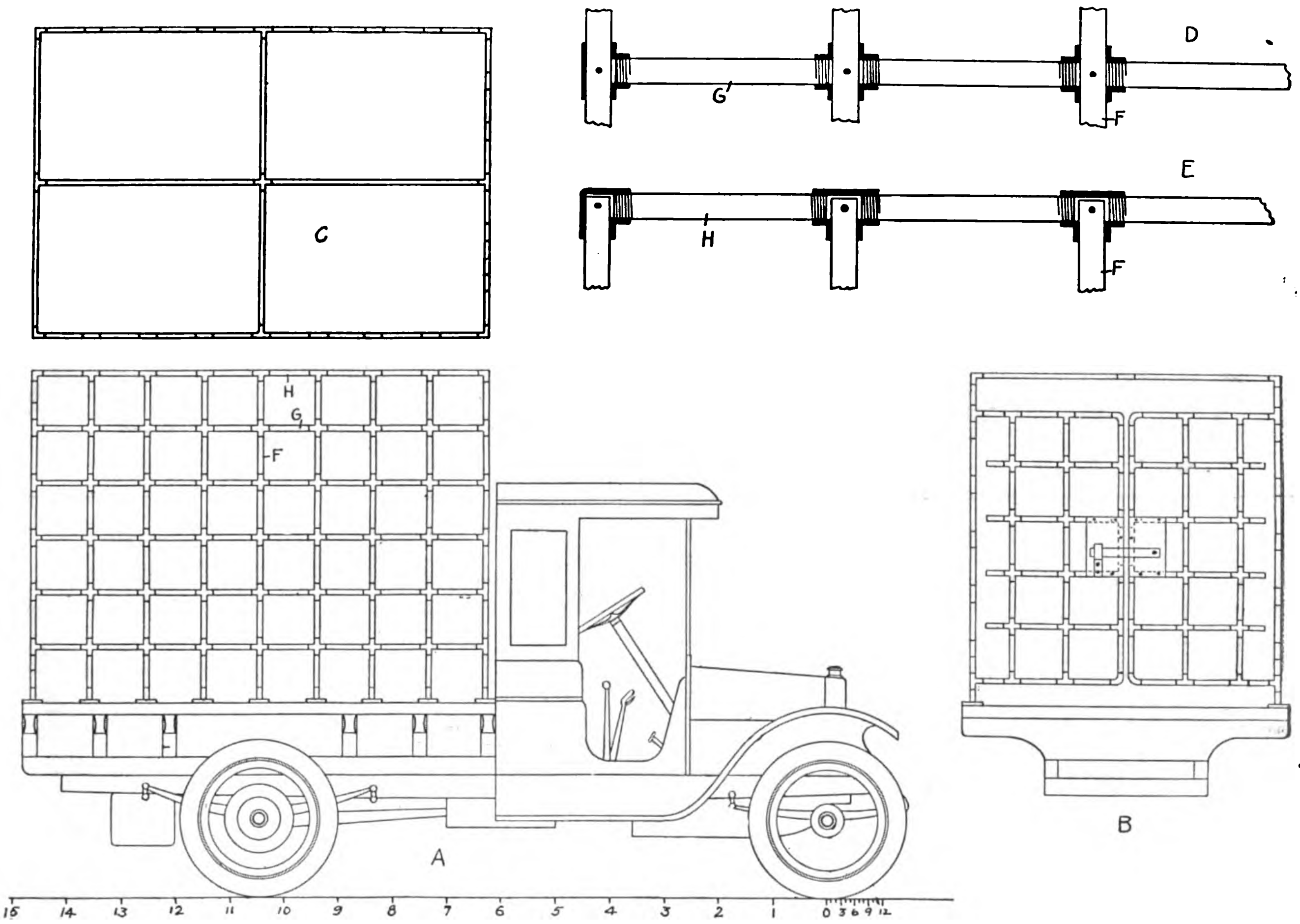
Many Advantages, Such as Strength, Short Time to Build, Long Life, Light Weight Make Simple Form Very Popular

WHEN it comes to the body for the small truck, or converted pleasure car chassis, in the great majority of cases, it must be very simple, cheap to build, cost little, wear a long time, and be efficient. Few bodies really measure up to all this, but the sketch herewith presents one that does, and has other advantages besides.

This is a pipe body, so called because it is assembled from standard iron pipe. The first of these, says Blacksmith and Wheelwright, was noticed in New York, where a manufacturer of paper cups had one built to carry cartons of paper cups. Carrying out the black and white scheme used by this company, the pipes were painted in vicinity. Iron tubing or piping can be obtained in lengths and cut and threaded by the smith. The special tee fittings can be purchased by the dozen and the smith will find that if he has orders for several bodies, he can save appreciably on the iron work as compared with the cost of one body.

Half or three-quarter inch pipe or tube is heavy enough. Whether tube or pipe is to be used depends upon the tee fittings. If pipe is used for the cross members, tube should be used for the uprights and the floor plates must be cut for tube instead of pipe.

By referring to the illustration it will be seen that the



Detail sketches of pipe body for small truck or car chassis. A and B, side and rear views. C, plan. D, side construction. E, top rail.

this striking manner, while the assembling of the pipe formed squares which harmonized with the alternate black and white squares used by this firm in its advertising and publicity. In these and other ways, the delivery truck was tied up to the advertising work, and did its share in making favorable publicity.

Since this first one, a number of other metropolitan firms have adopted the pipe type of open body, and as it is one which any handy body maker, plumber or smith can make quickly, it is presented in some detail. Its uses are so wide and varied that no good energetic builder should fail to dispose of a considerable number in his immediate upright members are slipped through the tees and ells while the cross members are screwed into place. Unless extra heavy tees are used, it will not be policy to ream the vertical openings to fit iron pipe.

Iron pipe is measured from the inside while tube is measured from the outside diameter. The inside bore of a ¾-inch ell or tee is approximately .937 of an inch and this bore may be reamed to one inch to fit one-inch tube uprights.

The base or the platform of the body is constructed upon two sills, each measuring five by three inches. These sills are spaced to fit upon the frame members or upon

Ideal Motor Car Body VII

Five-Passenger Enclosed Drive Cabriolet Espcially Designed for Automotive Manufacturer by Richard H. Burke

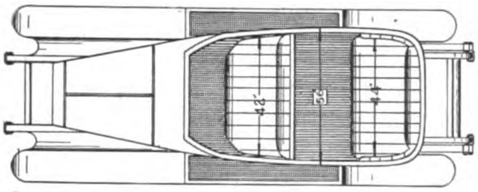
IMPORTANT points in a comparatively small capacity body are unusual freedom of space, that is sideways, as to leg room and otherwise. Another important point is the location of the seats between the axles in such a way that adequate comfort is assured.

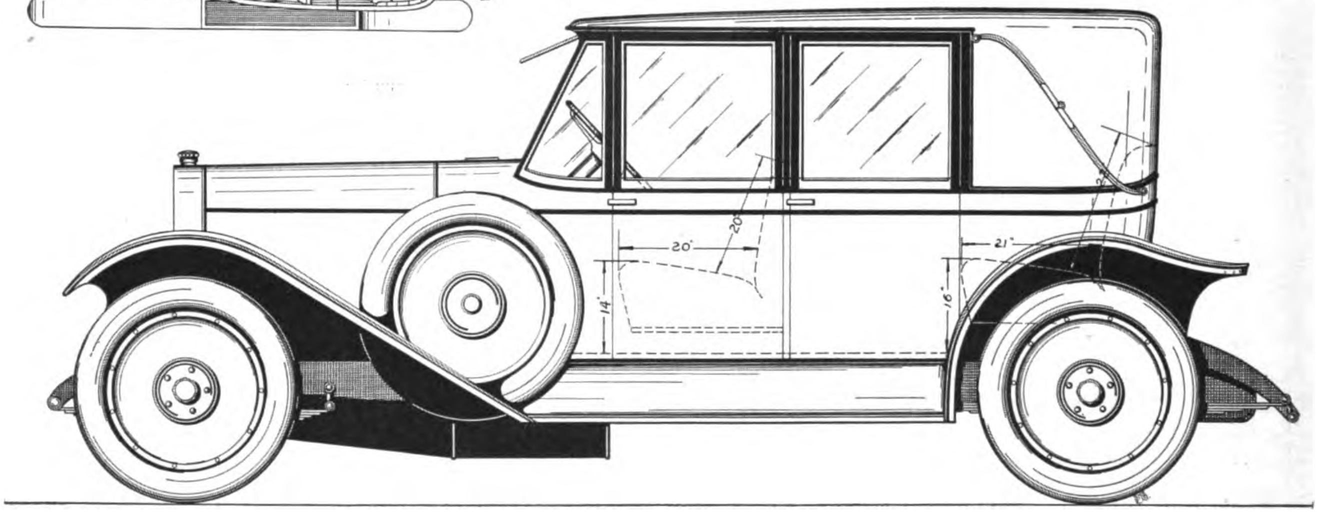
The design presented herewith, incorporates all these and many other delightful points of interest to the wealthy motorist. It has been especially laid out to meet the requirements of those desiring a car of admittedly smart appearance, one that is useful for business as well as for social requirements, but possesses ample facilities for carrying a considerable amount of luggage so that it may be used for long distance touring as well.

All these points are of real practical value, and the car possessing them should attract the attention of all classes of motorists.

We have taken as an outline for the subject an enclosed drive cabriolet type. The radiator and hood of this particular chassis are so well shaped as to permit of the stream line body, that is the molding beginning from the rear of the radiator out on to the hinge line of the hood continues along the side of the body and around the other side. With its large windows and double doors admitting plenty of light, the general dividing up of the surface sides of the body, develops a body of sturdy construction, while the body measurements of the chassis permit the generous leg room at each of the seats, the rear one being well forward of the back axle which is conducive to comfort and easy riding.

The body is to be mounted on the Lafayette chassis. Characteristics of the chassis: Wheelbase 132 in., tires 35 x 5 in., tread 56 in., body space 107 in.





The ideal five-passenger enclosed drive cabriolet body on Lafayette chassis.

Five Ten Hour Days at Reo Plant

Reo Motor Car Co., Detroit, has adopted temporarily a five-day work week made up of five 10-hour days instead of the former five-and-a-half-day week which, after two weeks operation, is declared to be working satisfactorily and giving the company a better production week than formerly. Fifty hours each week are put in by workmen as before without the breakover into the half-day at the week end.

While adopted primarily for the summer so that workmen would have more time for gardens and for week-end vacation trips, it may be extended over the full year as a more economic method of factory operation. Divided interest among the men on the short day made it difficult to keep up the high production of the rest of the week. In five 10-hour days, production is found to run considerably higher.

Plan Ford Branch Layouts 'Flat as a Pancake'

F. H. Low, superintendent of branches of the Ford Motor Co., speaking at a convention of the Society of Industrial Engineers, in Detroit, said that the company was working on an ideal layout for future branches, and that while present branches were from one to 12 stories high, all future branches would be flat as a pancake.

By adoption of a conveyor a mile and a quarter long, the Ford company, he said, had shortened the number of labor hours for assembling engines from six in 1913 to two hours and 10 minutes. A conveyor installed last year has allowed the company to do away with 150 trucks previously used to move castings and forgings.

The rapid growth in the use of motor trucks is indicated by the registration for 1921 which is 1,127,000, or about ten times the number in use in 1914.

the frame brackets and upon the sills are mounted six cross braces. These cross braces are shaped to overhang the wheels and form the base for the floor boards. In general, 1½-inch floor boards are heavy enough and should be used.

When completed the platform should measure 8 ft. 9 in. in length and 6 ft. in width. The floor plates are fastened to the extreme edge of the platform.

In assembling the framework, cut all of the cross members the same length, depending upon the size of the openings in the side. In the diagram, the cross members are 14 in. long, allowing 1 in. for "making up" the fittings.

The cross holes in the tees, ells and crosses are next reamed or bored to fit the upright tubes and then screwed into place upon the horizontal pieces forming the six frames. The tubes are then fitted with floor plates and after being fastened to the platform, the frames are slipped down over them. Pincer bolts passed through the crosses serve to prevent the parts from rattling.

For low sides and general construction tube and pipe framework is desirable because it combines lightness with strength. Though the cost of a pipe or tube frame body is comparatively high, one must remember that it will outlast six ordinary good bodies. Iron will withstand hard usage without showing wear, whereas wood dents and mars until the body is unsightly. The time required to build a body such as is illustrated is but little more than that required to build a wood body of the same design.

The illustration gives a good idea of the way to go about the construtcion of such a body, and with the aid of the directions just given any handy man should be able to turn out a creditable job. The drawing also gives a splendid idea of the appearance of the finished vehicle, and will suggest many uses not contemplated for an open body of this type, originally.

Doings at S. A. E. Summer Meeting

The Society of Automotive Engineers has secured reduced fare concessions from practically all of the railroads for its summer meeting at White Sulphur Springs, which convenes June 20. Special trains have been arranged to transport the eastern and western contingents. A railroad representative will be in charge of each train to see that everything runs smoothly. The midwest section will have special Pullmans out of Chicago. Detroit and Cleveland will also provide special Pullmans. Metropolitan, New England, Pennsylvania and Washington sections will all have special cars on the eastern train.

The technical program for the meeting is practically completed at this early date. Five sessions have been decided upon and will be known as the research session, fuel and engine session, passenger-car session, aeronautic session and motorbus session.

A report from the research department of the society will be presented by Dr. H. C. Dickinson in the research session. This report will treat principally the motor-fuel-volatility and highway research projects in which the society has been participating. Fuel tests will be described that are being conducted as outlined by the reseach department, the Bureau of Standards and the Bureau of Mines with the full support of the National Automobile Chamber of Commerce and the American Petroleum Institute. W. S. James of the Bureau of Standards will present a paper describing tests now underway as a part of the S. A. E. fuel research program. He will describe a device perfected by the bureau that records graphically the fuel consumption of a passenger car while it is being operated under ordinary driving conditions. An analysis of records kept over a long period reveals some rather unusuals facts which command the attention of all who covet an increased number of miles per gallon.

Several papers will be presented in the fuel and engine session. Thomas Midgley, jr., whose contributions are always received with interest, will submit some data on the characteristics of blended fuels. Two papers will be contributed on the pumping of oil in engine cylinders, a current problem demanding special study. One of these will be presented by an engine designer, A. A. Bull, and the other by a lubrication engineer, G. A. Round. A paper on the present status of the hot-spot method of handling fuels of low volatility will complete the group of papers in this session. This will be presented by F. C. Mock.

In the passenger car session, H. M. Crane will present a rather novel design of spring suspension for discussion. The wider adoption abroad of overhead camshaft passenger-car engines may indicate the tendency of future engine design in this country. At any rate, a paper on the subject is pertinent at this time and P. M. Heldt will present it in this session. J. B. Bray will present some constructive criticisms of the engineer's present attitude toward service and maintenance work. His paper will not deal so much with design as with practices of the average engineering department that are detrimental to the executive of an ideal service policy. The engineer's views on the same subject will be set forth in what promises to be a lively discussion of Mr. Bray's paper.

The aeronautic session will include papers on several phases of airchaft progress. Only two of these can be definitely announced at the present time, these being offered by Capt. G. E. A. Hallett, of the Air Service engineering staff at McCook Field, and Prof. E. P. Warner. Capt. Hallett will describe the methods followed by the Air Service in the design, experimental construction and testing of its new engine types. The paper by Prof. Warner will deal with a method of estimating airplane performance. The meetings committee hopes to secure additional papers for this session.

Two papers have been scheduled for the special motorbus session. G. A. Green, who has been identified with the motorbus ever since its introduction in New York City and elsewhere, will treat on the important factors that influence bus design and construction. R. E. Plimpton will submit data showing the unusual growth of bus transportation and compare the many types of bus chassis now produced, indicating the particular service to which each is suited.

The companies in the industry have contributed liberally to the prize-purchase fund and the sports committee assures the S. A. E. members an especially complete sports program. Tennis, golf, swimming, track and field events will be arranged for the men. Croquet, golf, quoits and cards will test the skill of the ladies

The entertianment committee is planning many diversions for the ladies who attend the White Sulphur Springs meeting. Several novel deparatures are to be featured; and the evening dances and movies of past meetings will be outdone.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIV MAY, 1922 No. 2

Oil Cooling Offers Possibilities

THERE has been developed in England recently a novelty in automobile engines which offers interesting possibilities if its road and service tests live up to the claims and expectations. This is a four-cylinder, overhead value motor, and the novelty consists of combining the lubricating and cooling systems in such a way as to give equal or better cooling effect, at the same time eliminating the radiator, the usual water hose connections, water pump, and other parts of the water system.

This is accomplished, as described elsewhere in this issue, by carrying up the crankcase in a box-like form which encloses the entire engine except the overhead valves. Naturally this large, box-like space has a good sized interior. Within this, some 1½ gallons of oil are in constant circulation, a good sized pump being used to circulate this at the rate of 6 gallons a minute. This rapid rate of circulation keeps the interior constantly filled with an oil mist, so that good lubrication is assured, but the circulation of such a quantity promises a very good cooling effect, and this is perhaps twice to three times the usual rate of water circulation.

Naturally, such a plan necessitates a special design of crankcase and cylinder block, but this is claimed to further the cheapening of the engine rather than hinder it. The crankshaft and camshaft are on ball bearings but this is a detail of construction not a necessity in the cooling scheme. A small tubular radiator is used, but if the method proves successful, there seems no reason why it may not be carried further, and the quantity of oil doubled, tripled or quadrupled, and the radiator eliminated.

Since it is claimed that this four-cylinder motor can be produced at the same cost as an air-cooled two-cylinder of equal bore and stroke, the two-cylinder air-cooled engine being a favorite small unit in England, this new simplification promises economy as well. There is claimed to be no carbonization, nor appreciable loss of oil up to 6,000 miles, the extent of the tests up to the time the description was written. This points out further economies of operation, in lubricating oil, and in having cylinders cleaned because of carbonization. Other claims are made for the engine, but even these it would seem, are sufficient to warrant a serious consideration of the general scheme for application to American cars.

Fuel Storage and Production Improved

WHILE it might seem like a strange thing to say, with the total number of cars and trucks in use approaching the eleven million mark, and all makers figuring on this year's production equalling or exceeding the previour record year, 1920, it looks as though the curve of gasoline consumption is flattening out. That is, it appears that production of crude and gasoline from it have been stimulated to such a point that they are now several jumps ahead of consumption. This reassuring conclusion is drawn from recent figures which show that the stocks of gasoline in storage as of March 31 have gradually gone from 546 million gallons in 1919, to 626 million in 1920, to 713 million in 1921, to 854 million in 1922. The addition to stocks on hand each year has increased from 80 million gallons in 1920 (over 1919) to 87 millions in 1921, to 141 millions this year. That this should be the case in view of the remarkable increase in the number of cars produced and put into use shows what the petroleum industry can do when pressed on by urgent demands and corresponding high prices.

Incidentally crude production is increasing, the week ending May 13 showing an average of 1,422,400 barrels daily, as compared with 1,407,000 the previous week, and 1,317,240 last year.

However, these figures do not mean that gasoline is going to be cheaper, on the contrary, New York has seen four successive increases in as many weeks of 1 cent a gallon.

Price Situation Apparently Stabilizing

THAT price reductions of motor cars have about run their course is apparent from the developments of the last month. It is true that Marmon, Kissel, Stephens, King, Westcott, and Brewster have lowered their prices, the first-named by a very considerable amount, but the influence of these cuts, together with the pevious action of Franklin and others, appears to have been negligible. Taken all together, these most recent cuts appear more like a straightening out of inequalities in prices as compared with competing makes. Two of the number have been in difficulties for some months and the price reductions appear to have been made as a rather belated attempt to improve the conditions of the companies through increased sales stimulated by reduced prices. The others are all in the higher or highest price classes, and it is difficult now to say what the effect will be.

At any rate, it appears that the industry will not be stampeded into another round of reductions, in fact all signs now point to this situation as being entirely closed. One maker has been obliged to increase prices by $20. The amount and action shows just about where the majority of makers stand, and if the year's expected large volume of new car sales should not materialize, there will be many more increases. Fortunately, all present signs point forward to the best year the industry has ever seen.

Gasoline from Oil Shale

BY RALPH H. McKEE*

Preliminary Discussion of Present Sources of Gasoline and Its Possible Substitutes — Cracking Processes—Scotch Shale Oils—Fuels from Molasses.

THIS American gasoline substitute has a big advantage over ordinary gasoline in that the cylinders do not carbonize. This keeping of the cylinders clean means ordinarily a greater (11 percent) mileage per gallon than is obtained from gasoline. On the other hand, the price of the product has been kept slightly above that of gasoline and the company making same is handicapped by the variation in the markets from time to time, of the supply and price of each of the three constituents. In other words, if the supply of benzol distillate on the market is small then it ceases to be practicable for them to put out any large amount of alcogas, no matter if they do have a surplus of the other constituents. Such an alcohol-ether mixture suffers, though not to the same extent as Natalite, with the tendency to "knock" and to corrode the shipping containers and storage vessels. It is reported that the company has been studying this phase very carefully and that it expects to put out a product soon, which is as free from corrosion troubles and "knocking" as good grade gasoline. This will increase our supply of motor fuel and broaden the commercial outlet for benzol products and alcohol, besides being a boon to automotive manufacturers in that a more or less permanent source of fuel supply will become an element in future production figures and estimates. In this way, success in this particular direction will help to stabilize the industry. Petroleum requirements of this country are steadily increasing, the amount of the increase being about 50,000,000 barrels a year. In part, this is due to the increase in fuel oil requirements, but the larger part by far is due to an increase in gasoline requirements, and this in turn is almost wholly automotive in character. Apparently the gasoline requirement of the country is going to continue to increase and probably at an even greater rate than in the past. This is well shown in the table below.

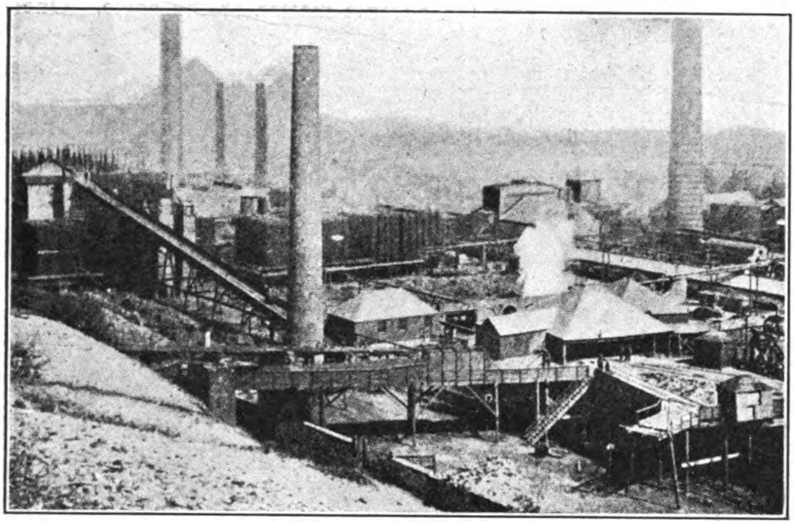


Fig. 1. General view of the Pumperston Shale Oil Plant.

The prospects for an increased supply of petroleum from American oil wells are nil. The investigation of the U. S. Geological Survey and of the U. S. Bureau of Mines show quite definitely that the United States is approximately at the peak of its production, and that within a very few years, probably within three years, the production of petroleum in the United States from wells will begin to fall off.

Moreover the Geological Survey calls attention to the fact that we should not expect to find any more large fields of petroleum in the United States. In other words, that practically all of the possibilities in the way of large petroleum fields in this country have been well prospected and that now we can calculate fairly well what the production will be in the future. This calculation shows quite definitely that it is soon to decrease in amount. In the past, as at present, the United States furnished approximately two-thirds of the world's production. But we are consuming more than we are producing, for example in 1919 the United States imported fifty-three million barrels from Mexico, and in 1920 one hundred and six million barrels. In 1921 the importation was twenty million barrels more than in 1920. In each year the United States has imported roughly about 60 percent of the total production of Mexico.

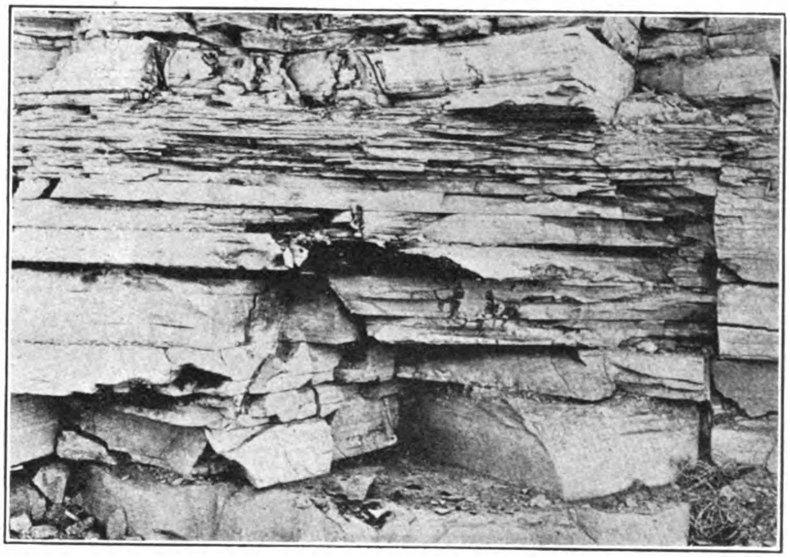


Fig. 2. Massive shale, Utah.

Mexican and Texas fields are short-life type of fields, already they are in some places furnishing salt water instead of petroleum.

* Professor of Chemical Engineering, Columbia Univ., New York City. Abstracted from address presented before Section of Physics and Chemistry, Franklin Inst., Philadelphia, Pa., January, 1922.

Four years ago, after a careful canvass of the situation showed that there was relatively little known about many of the fundamental factors upon which a successful shale oil industry must be based. For example, almost nothing was known regarding the heat of reaction by which shale oil is formed from the organic material of the shale. Little was known regarding specific heats and latent heats, but nothing was known regarding the first reactions that control the formation of oil from the organic material. In the thought that this was going to be an industry of great importance to the country and that the knowledge of the fundamental factors on which the industry is based were essential to a proper development of that industry, we undertook at Columbia University the study of these fundamental factors. I may add that since that time I have had four different graduate students working on various parts of these problems. A large part of this work is, of course, yet incomplete, but results have been obtained that are of the utmost importance. It would take several evenings to discuss the methods used and the data obtained. Tonight I can only give you results.

Table I. U. S. Production Motor Vehicles.

	Passenger Trucks	Tractors
1916	1,493,617	116,670
1917	1,740,792	190,629
1918	926,388	359,947
1919	1,657,652	480,954
1920	1,883,158	525,246

Total number (9,500,000) in use in 1922 is nearly three times number in use in 1915.

Table II. Barrels Crude Oil in U. S. (U. S. Geological Survey).

	Production	Consumption
1910	205,000,000	205,000,000
1912	225,000,000	225,000,000
1914	265,000,000	280,000,000
1916	300,000,000	320,000,000
1918	350,000,000	410,000,000
1919	377,000,000	418,000,000
1920	443,000,000	531,000,000

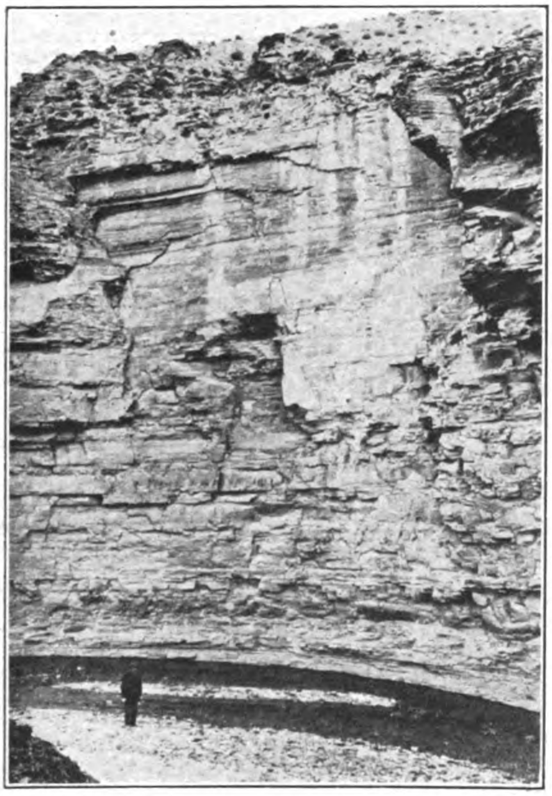


Fig. 5. Paper shale, Colorado.

Table III. U. S. Gasoline Production.

1917	2,850,000,000 gallons
1918	3,570,000,000 gallons
1919	3,960,000,000 gallons
1920	4,880,000,000 gallons

Of which 15 to 20 percent is produced by cracking and about 10 per cent from casing head gas.

One of the most important factors entering into the design of a proper shale retort is that of the knowledge of amount of heat absorbed or evolved in the formation of shale oil from the organic matter of the shale. One of our men devised the first apparatus capable of directly determining this factor and found that heat was absorbed in the process, and that the amount of heat absorbed was nearly the same for shales from different sections. This heat absorption amounted in general to about 450 calories per gram of oil and gas produced, or in other terms, 160 B. T. U. per pound of average shale retorted. This is a surprisingly low figure for such a reaction.

It has been generallly thought that the organic matter in shale decomposed on heating to form petroleum products as the primary products of decomposition. It has been shown by these researches in the chemical engineering department at Columbia University that this is not the case, but that the primary product of the decomposition is a heavy solid or semi-solid bitumen and that petroleum is formed by a secondary cracking process from this semi-solid bitumen. This cracking process by which petroleum products are formed is a liquid phase cracking process similar to the well-known phenomena of the cracking of petroleum to give gasoline such as that of Burton.

Another surprising thing found was that the decomposition temperature of the shale to give the semi-solid bitumen was a quite definite temperature, one with 400 deg. and 410 deg. C., as its limits.

The investigations have also shown to be incorrect the belief which has been held by many of those working on the developments of shale oil manufacturing process, that on heating, gasoline is the first product formed; then on higher heating kerosene; and on still higher heating lubricating oils, etc. In other words, it was shown that what happens on heating is that all these products are formed simultaneously by the cracking of the semi-solid bitumen first formed.

The true oil shale is a clayey or sandy, shaley deposit from which petroleum may be obtained by distillation, but not by treatment with solvents. Sometimes certain sand deposits are saturated with oil or asphalt. From these the oily constituents can be removed by solvents and, accordingly, are not commonly considered as true oil shales, but instead, go under the name of oil sands. Moreover, they are relatively small in extent and apparently have minor industrial possibilities.

Oil shales vary among themselves not only in yield of oil per ton of shale, but also in type of oil, type and character of minor constituents, and also even in the gangue material which carries the organic portion.

In Scotland they are working oil shales which furnish but 20 to 22 gallons of oil per ton of shale mined. In this country we have large deposits of shales which are able

to give much higher yield of oil. The largest of these deposits are the Green River shales of Colorado, Utah and Wyoming. There are also large deposits in Nevada, California, Kentucky, Indiana. Ohio. New Brunswick and Nova Scotia, and smaller deposits, though large enough for commercial exploitation, in many other portions of this content. There are similar deposits in other parts of the world. Of these deposits which are likely to be exploited in the next decade, we have variations in yield from 20 gallons to 60 or even 80 gallons per ton. The large deposits of better grade will give about a barrel (42 gallons) of oil per ton of rock. The character of oil produced in some cases is apparently a straight asphalt type petroleum similar to California well petroleum. Other shales give a large quantity of paraffin wax or even better quality than that given by the best oil wells of Pennsylvania's history. In the opinion of the speaker the average petroleum to be made from American oil shale will resemble most closely the petroleum obtained from the present mid-continent field, such as the Oklahoma oil.

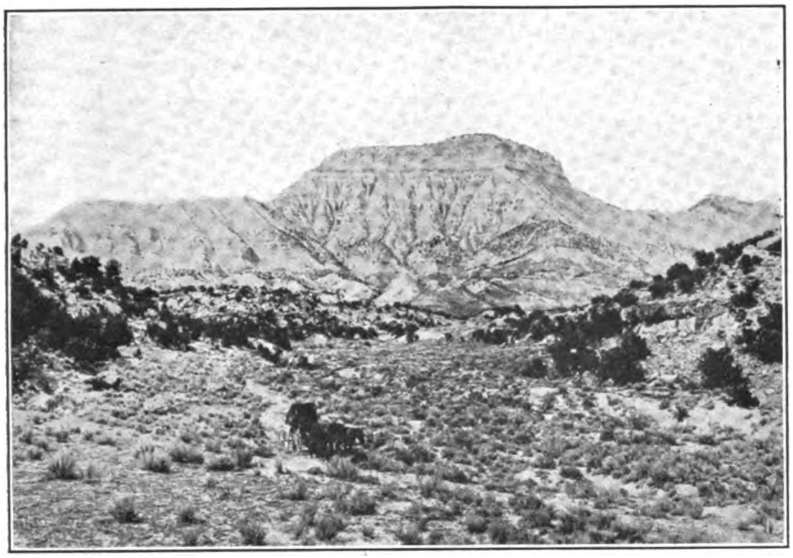


Fig. 4. A mountain of shale Colorado.

It is not commonly appreciated how large these oil shale deposits are. If we consider only those oil shales which will furnish a barrel or better of petroleum per ton of shale (a barrel is 42 gallons) we have in the Green River section alone in known deposits sufficient to furnish 64 thousand million barrels of petroleum. This is an enormous amount. It is eight times larger than the total of the well petroleum that this country has produced since Col. Drake drilled the first oil well in 1859 at Titusville, Penn. It is more than five times the total production of the world since well petroleum became commercial 60 years ago.

If we are to have gasoline in quantity from shale oil we must make the crude shale oil and then crack it by some one of the oil cracking schemes. By the most used present method of cracking, that used by the Standard Oil Co., the gasoline as made will not be one of high quality. It will be strong odored, will color on standing, and will be inclined to carbonize the cylinder. On the other hand, its heat value per gallon will be greater and, accordingly, in a properly designed motor it should give a slightly higher mileage than old fashioned gasoline. On the other hand, if we used the McAfee process of cracking, we would get stable, water white, well keeping, pleasant odored gasoline of the old type. However, it is to be remembered that the McAfee process is a more expensive type of oil cracking. At present in Scotland they are using the ordinary scheme of cracking in which considerable quantities of unsaturated compounds are formed, as high as 60 percent. This motor spirit is commonly used by the public and it is not considered by the general public in that country to be of lower grade than gasoline from well petroleum.

In distilling most oil shales to get petroleum there is formed simultaneously considerable quantities of ammonia from the nitrogen constituents of oil shale. This ammonia is usually absorbed in sulphuric acid, recovered and sold in the form of ammonia sulphate for fertilizer uses.

A shale oil plant, then, to be successful, must be able to handle cheaply and efficiently large quantities of oil shale, distilling it to get the crude oil and ammonia and then crack and refine the crude oil to give a motor spirit useful commercially. The Scottish plants do this, excepting that they devote considerable attention to the recovery of paraffin wax, and it is only the oil left after the wax recovery that is distilled to give lubricating oils, gasoline and burning oils, or is cracked to give shale gasoline.

The Scottish shale retort is a retort of vertical pipe type. When we attempt to handle American shales in this retort we find that they give trouble owing to the pieces of shale sticking together and sticking to the sides of the retort. This caking of the shale lumps stops the passage of the shale through the retort. For use on most American shales it is quite apparent that we must either modify this Scottish retort or devise retorts on new lines. The Scottish retort is designed with the dual purpose of

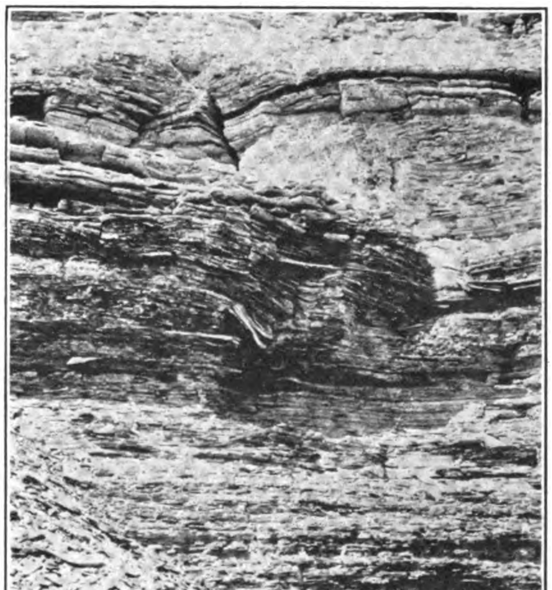


Fig. 3. Oil shale cliff, Utah.

recovering ammonia from the shale and the obtaining of oils. With the American shales we have larger amounts of oil, but ordinarily distinctly less ammonia than is produced from the Scottish shale. In other words, the retort to handle the American oil shale properly must be one which gives its attention primarily to the production of oil in quantity and of acceptable quality, and only secondarily to the production of ammonia. There are more than a score of retorting schemes which have been proposed by various American inventors. None of these has yet produced shale oil in large quantities. The most completely developed plant and process is that of the Catlin Shale Products Co., at Elko, Nev. They have a plant which has produced approximately 100,000 gallons of shale oil. They have a small commercial refinery almost completed, and it is probable that the first shale oil and shale gasoline to be marketed in quantity in America will come from this plant. There are probably several other types of retorts which have been proposed for use in distilling oil shale which would, if given proper technical study and trials, develop into commercial processes. At present few except the inventor himself believe that any of these retorts is certain to be practicable when used on a large scale. The ideal process will be one permitting the operations to be carried through on a large scale with minimum labor and with the recovery of good yields of commercially utilizable products.

It is only within the last five years that serious attention has been given to the question of the development of a proper type of retorting still, and we have no reason to think but that well before the same length of time from now has passed we will have succeeded in obtaining a retorting scheme which can handle with low labor costs efficiently and economically American oil shales.

It is not commonly appreciated with how few men a manufacturing plant of chemical nature can be run. Generally speaking, in such processes labor is a minor factor, but in connection with most of the retorting processes yet proposed labor and power requirements are large and will be approximately one man per barrel of refined product, if mining as well as retorting and refining are included. This is the Scotch labor requirement, but we must reduce this labor requirement if we are to have in America a really successful shale oil industry.

The demands for petroleum, it has been shown, are increasing in this country at the rate of about fifty million barrels a year. If this continues it will require each year 75 new plants, each handling 2,000 tons of oil shale a day and representing an investment of a million dollars each to give sufficient oil to meet this yearly increase, to say nothing of exceeding it. We have no other source of fuel oil or gasoline or gasoline substitue in prospect which promises to furnish even a minor part of this demand. In other words, we have reason to look forward to a very profitable chemical manufacturing industry which will rank with our largest manufacturing industries in its labor and capital requirements and in value of output.

There are 984 motor express lines in the United States which have been listed at the offices of the National Automobile Chamber of Commerce. The total number of motor express lines in the United States is estimated at 1,500. The tendency each year is toward consolidation, with fewer lines doing a larger business.

Fiftieth Anniversary of the Carriage Builders' National Association

The Carriage Builders' National Association will celebrate its fiftieth anniversary this year in New York City, the week of Oct. 9. The sessions will be held at the McAlpin hotel and will be attended by many of the old-timers of the carriage building industry. For a number of years the conventions have been held in the middle west, but New York was chosen for the golden jubilee because it was here that the organization was born.

When the call went out in July, 1872, to the carriage builders of the country for a meeting to be held in New York City to consider the advisability of forming a national organization, there was a hearty response and the result was a gathering of representatives from 18 states at the St. Nicholas hotel on Nov. 19, and the formation of the Carriage Builders' National Assn. headed by Hon. C. P. Kimball of Maine. The other officers elected were: Treasurer, J. W. Britton, New York City; secretary, Wilder H. Pray, New York City; vice presidents, E. A. Abbot, New Hampshire; F. D. Parry, Massachusetts; Edward Wells, Connecticut; John Green, Delaware; Clem Studebaker, Indiana; J. L. Freeman, New Jersey; Benjamin Bruce, Ohio; James Cunningham, New York; D. M. Lane, Pennsylvania; William Bowers, Maryland; H. B. Osborne, Missouri; Henry Willets, Illinois; F. P. Wallis, Wisconsin; Hugh Johnson, Michigan; G. A. Ainslie, Virginia; F. Simmons, Maine; A. A. Wheeler, Kentucky; A. Woeber, Iowa. The executive committee consisted of J. W. Britton, C. F. Dibble, W. D. Rogers, Henry Killam, R. M. Stivers, William H. Gregg, and J. Woodruff.

There will be the usual exhibition and the annual meeting of the C. H. A. T., the companion organization that has done so much to help entertain the delegates.

The invitation is sent out by the officers of the association who comprise the following in part, and who are going to make every effort within their power to make the golden anniversary convention a notable one: President, P. E. Ebrenz, St. Louis, Mo.; secretary and treasurer, George W. Huston, Cincinnati, O. Executive committee, H. A. White, High Point, N. C.; Clen Perrine Cincinnati, O.; R. S. Triplett, Owensboro, Ky.; A. H. Ahlbrand, Seymour, Ind.; W. H. Roninger, St. Louis, Mo.; Theodore Luth, Cincinnati, O.; E. E. Hughes, Lynchburg, Va.; W. H. McCurdy, Evansville, Ind.; F. H. Delker, Henderson, Ky.; C. R. Crawford, St. Louis, Mo.; T. M. Sechler, Moline, Ill.; R. J. Jones, Henderson, N. C.; W. C. Martin, Carpentersville, Ill.; S. R. Ewing, jr., Owensboro, Ky.; Homer McDaniel, Cleveland, O. Ex officio, P. E. Ebrenz, St. Louis, Mo.; T. J. Hackney, Wilson, N. C.; G. W. Huston, Cincinnati, O.

Hickok General Manager D. Wilcox Mfg. Co.

F. F. Wilcox has resigned as president and general manager of the D. Wilcox Mfg. Co., Mechanicsburg, Pa. He has been succeeded by S. F. Hauck, who assumes the duties of chief executive according to the by-laws of the company. M. E. Anderson is secretary and treasurer, L. E. Hickok has been elected general manager, and Miss G. L. Campbell assistant general manager. H. C. Brown is superintendent.

The Design of the Two-Seater

The motorist admires the sporting and other types of bodies with their low seats and general restricted outlines, but, here and there, we think, he is pausing to consider the merits of less rakish designs which offer a greater degree of comfort. We do not, however, foresee a reversion to the high seats and upright steering columns of 25 years ago, but there is evidence of an increasing demand for less exaggeration in the arrangement of seats, doorways and headroom, especially with the two-seater, whether it be an open body or a single coupe.

We are all familiar with the very low and inviting deeply-sprung armchair, sometimes the ideal piece of furniture for the repose of the potential customer, but most of us like a chair in which one can comfortably sit, rather than sink into, and also get up out of easily. A seat should be sloped so that it is a couple of inches or so higher at the front than at the back, and the cushion should not be wedge-shaped, but made parallel so that the same depth of spring foundation is maintained throughout.

A good average height of a driving seat is from 11 to 12 inches measuring from the floor to the top of the cushion, which if well made need not exceed 7 inches in thickness. A tall man will probably find that he will want 15 inches for this particular dimension.

Although many are willing to acknowledge the superiority of a higher seat, they are apt to forego its advantages when it is discovered that it entails raising also the top line of the body side and back rail, since a small body is apt to look rather tubby if designed with deep panels. Still, this effect will be lessened if the hood is high and the lines of the rear boot are skillfully molded. A belt-rail, if painted a lighter color than the main panelling, will also tend to decrease the apparent height.

The height of the seat, however, should depend on the position of the steering column, and if this has considerable rake it may be difficult to arrange for the height of seat required. A steering column, however, should always be adjustable so that its angle may be varied within reasonable limits. If no adjustment of the pedals is possible then the raising of the seat should be forward along the line of the arc struck from the pedal centre.

The width of doorway of a two-seater is not of much importance so long as it is being used as an open car, and the seat does not encroach too far forward into the gangway. When, however, a deep scuttle is adopted it is seldom that a proper width of seat can be arranged without it occupying at least half the available doorway, which is usually made worse by the door being hung on the forward pillar. A simple method of getting over the difficulty would be to hinge the seat itself so that it could be pushed up or spring up automatically when not in use.

The headroom of a private car is designed in relation to the height of the seats, but we think in many cases that the roof line has not only to be brought down to conform to a lower seating position, but the normal allowance has been disregarded for the seated passenger so that his headgear actually touches the twill or roof lining when the body is closed. The curve of the roof will also further restrict the available height of the entrance so that it becomes quite an acrobatic feat to enter or leave the body. It would appear then, that without going to the other extreme, greater convenience would be achieved by the use of a flatter roof line and at least 3 foot headroom off the top of the cushion.

The modern dickey seat is far more comfortable than the old pattern with the seat opening out on top of the boot. The sunk seat, whether fixed or of the revolving type, being arranged inside, the boot sides cannot be made wide enough for two unless the boot itself is of generous proportions. A wide boot with straight sides is apt to look ugly because it will hide most of the rounded hind corner of the driving seat panel. If a fairly long dickey seat is required the seat and boot panels should be continuous, which allows an unbroken line of molding to be adopted along the elbows from the dash to the rear end of the boot. The ease of getting into the hind seat would often be enhanced if a small doorway were framed into the boot side. Probably it is omitted, in these instances, where there is plenty of room for it, because it is considered an eyesore. If it is so regarded then it may be arranged on the off-side only.

The length of the boot has often to be restricted, although the distance from the dash to the end of the frame is not below the average, but owing to the amount of space taken up by the steering. Still, if the driving seat is high enough at the back to allow the toes to be placed under it, this will provide the few extra inches of leg room required. The dickey seat should be brought as far forward as the front one will permit so that at least half of it is in front of the rear axle. The body designed to suit exactly the individual requirements of the owner can be made to look as well as one built to please the eye only. Also in these days of enforced economy and low prices the more comfortable type of body need not cost any more than the extreme sporting type.—Auto & Carriage Builders' Journal (London).

Paris Has Motor Hansom Cab

A hansom cab has been placed on the streets of Paris which reminds one of a pattern of body which was occasionally adopted in the earlier days of motoring. The main portion of the body has a cabriolet outline with the conventional pair of curved folding doors opening outward in front of the passengers, and a fixed upper portion and a high dickey seat. These bodies, we understand, are mounted on Ford chassis which have been altered considerably in outward appearance by the mounting of larger diameter wheels, a new radiator and bonnet, domed wings and, of course, an entirely new arrangement of steering gear. Headlamps are fitted as well as pillar lamps. The side lights are made to drop. There is a neat scuttle dash, behind which luggage can be accommodated on the floor and as far back as the opening of the doors will permit. It is remarkable how the single and three-quarter landaulette type of body has been adopted without question as practically the only possible style of cab suitable for public hire in the London streets and elsewhere. Why not revive the hansom cab body which, as a four-wheeler, no longer possesses the alleged dangers of the two-wheeler drawn by a horse which may stumble and fall? Also there is no reason why more neatly appointed limousines should not be used for this class of work, or even "growlers." This vehicle, however, was a small square-fronted brougham, and the question of wheelbase and restricted turning radius demanded by the licensing authorities would necessitate the elimination of the square front between the driver's seat and doorway. Still, the single brougham type could be provided for those who prefer the seclusion offered by the panelled hind quarter.—Auto & Carriage Builders' Journal (London).

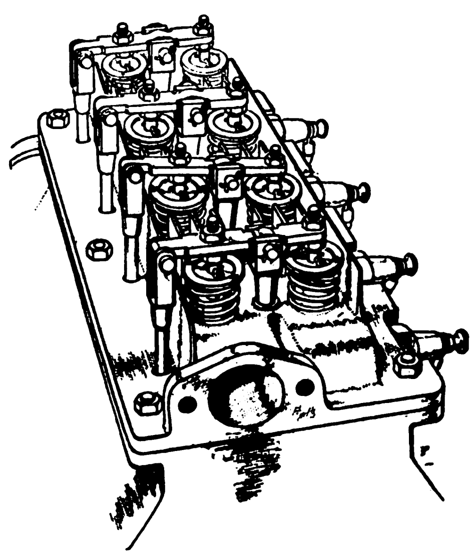
British Car With Oil Cooling An Important Improvement

Simplicity and Low Cost of Production Combine With a Strikingly New Idea of Combinating Lubricating and Cooling Systems—Tests Prove Practicability.

WITH that great readiness with which American designers as a rule take up anything new in car construction which shows marked promise towards simplification, lowered cost of production, marked utility or other promising qualities, a novelty just produced by an English firm should meet with great favor. This is particularly true, since it presents not one or two of the desired qualities mentioned above, and for which every designer is said always to be seeking, but according to its designers and the representative of an English technical journal, all of them.

What follows is largely this man's own story, taken directly from The Autocar (London), as is the figure. Unfortunately, the half-tone illustrations showing the exterior and general appearance of the engine were so poor as to be impossible of reproduction. In a general way, the sides of the motor case are carried out wide, starting from a flat bottom of the oil pan, and this width is carried right up to valve gear as shown. In fact the outlines of the upper parts of the sides of the enclosure may be seen therein.

The principle of utilizing the engine lubricating oil, instead of water or a direct air draught, for cooling the



Overhead valve gear in the new Marseal (British) engine which is oil cooled, internal circulation of lubricant at high velocity serving for lubricant and cooling. Each pair of valves is operated on the push and pull system, the long operating rods being within the engine enclosure except the upper end as shown herewith.

cylinders has come into considerable prominence during the past 12 months or so, but hitherto it has been applied only to two-cylinder engines, with their cylinders horizontally-opposed or set V-fashion on the crank case. A pronounced development is therefore evident in an engine made on this principle by Marseal Motors, Ltd., Coventry, for it has four cylinders arranged in line ahead and vertical, in accordance with usual practice in watercooled motors.

Up to the present two experimental engines have been made with a bore and stroke of 60 x 90 mm. (1,018 c.c.), one of these having been tested in a chassis over a distance, we are informed, of approximately 6,000 miles; the other has been subjected to the usual bench tests. As a result of the excellent showing made by both engines, it has been decided to go ahead with the type, and the first batch of the production model has been put in hand embodying a few minor variations which experience has shown are advisable. Simplicity of design is an important feature, so much so that it is claimed that a four-cylinder engine on these lines can be produced at a cost no greater than that of a two-cylinder air-cooled motor.

The aluminum crankcase is extended upward to carry the cast iron unit forming the head of the four cylinders, the cylinder barrels being a separate cast iron block depending some five and a half inches within the case, well clear of the sides of the latter. In the experimental engines the cylinder barrel unit is flanged at the top and bolted up to the underside of the head, but in the production model its flange is wider and rests upon the top of the crankcase, the flange of the separate head being superimposed upon the cylinder flange, thus enabling the three units to be held together by six exterior bolts and nuts.

A Radiator for the Oil

The crankcase is a three-part unit, consisting of the main or central portion and two end plates extending from top to bottom, the end plates supporting the counter-weighted crankshaft in two large ball bearings. Below the crankshaft is an open sump, the total oil capacity being one and a half gallons. The camshaft also runs on ball bearings, and drives at its front end a large oil pump of the vane type. This pump, we are told, circulates the oil at the rate of six gallons per minute at 2,000 r.p.m. crankshaft speed, and in its circuit the oil passes through a tubular radiator similar to the usual water pattern and located on the chassis in the normal position at the front.

The pump delivers the lubricant through a branched pipe leading to two conduits, one at each side, running from end to end within the crankcase alongside the top of the cylinder barrels; issuing from these conduits through a series of small holes, the oil is sprayed directly upon the sides of the cylinders, runs down a cascade, and falls off the lower ends on to the rotating crankshaft and big ends.

No troughs or drilled oilways are required, splash lubrication serving for the camshaft, timing gears, pistons, and the interior of the cylinders. The last-named have slotted baffle plates enclosing their lower ends, the slots allowing a sufficiency of oil to pass upward and providing clearance for the connecting rods. Beyond the baffle plates no special provision is made or required to prevent over-lubrication, as evidenced by a smoky exhaust, and each of the cast iron pistons has merely two ordinary compression rings above its gudgeon (piston) pins.

The distribution gearing consists of three straight-toothed pinions, a steel one on the crankshaft driving a phosphor bronze wheel on the camshaft, this in turn engaging with a steel pinion on the drive shaft of the mag-

neto, the latter having a spigot mounting on an extension at the top of the front end plate of the crankcase.

A large proportion of the underside of the cylinder head—in which the seatings of the overhead valves are located—is exposed to the cooling effect of the thick "fog" of oil which constantly exists in the crankcase while the engine is running, and although longitudinal radiating fins are cast on the top of the cylinder head, these are not considered essential, and air draught is not depended upon to keep the temperature uniform and within bounds.

Novel Valve Operating System

The valve gear is a special feature apart from any consideration of the cooling system. There are four cams only on the camshaft, and there are but four rods and rockers, the former acting as push-and-pull rods, and the latter operating the inlet valves in line at one side of the head, and the exhaust similarly arranged at the other side. But, by reason of the peculiar design of the cam followers —which at the moment we are not permitted to describe— the one cam for each pair of valves is made to give different periods of valve opening for inlet and exhaust respectively, and that, too, without in the least degree affecting the valve clearances, though valve overlap is, of course, eliminated by this arrangement.

The detachable cylinder head casting has formed with it as a unit both the inlet and the exhaust manifolds, that for the inlet having a flange at its forward end for the carburetor, while the exhaust runs back to a flange for the outlet pipe to the silencer. The spark plugs are not screwed into the cylinder head, but into bosses on the sides of the cylinders, these bosses registering with holes in the crankcase casting through which a part of the body of each spark plug passes.

Extreme Engine Accessibility

In connection with the experimental engine and chassis, it has not been found necessary to fit a fan of any kind, the oil being kept quite cool by the air draught through the radiator caused by the passage of the car. As showing that, despite the large quantity of oil in circulation, over-lubrication does not occur, we are told that in the 6,000 miles running, decarbonization has not been necessary. When decarbonizing does become advisable with the production model, it can easily be carried out, for it is merely necessary to cast adrift the rockers and operating rods and remove six bolts and nuts in order to lift the cylinder head; even the pistons and rings can then be examined or removed by lifting out the cylinder barrel block, while the crankshaft with connecting rods and pistons attached can be withdrawn endwise by removing one of the end plates.

At the time of our inspection of the bench-tested engine, the chassis with the second experimental engine was under test in Wales, so we have not had an opportunity of observing its behavior on the road. But, so far as design goes, the engine is obviously of considerable interest, if only because it carries further a principle of cooling which has great promise and which opens the way not only to increased efficiency, reduced weight, and greater simplicity, but also to lower cost of production.

The U. S. Bureau of Mines reports a gasoline reserve of 818,500,000 gallons, the highest on record. Opening up of new fields and improved cracking processes during the past two years have greatly increased fuel production.

Shipping Is Most Exacting Work

The infinite care and pains which a motor car manufacturer will employ in order that his product will reach the purchaser in the highest possible state of perfection was illustrated the other day by R. H. Collins, president and general manager of the Peerless Motor Car Co., of Cleveland, in describing to a group of visitors the company's packing methods for shipment.

"First, the freight car itself is thoroughly cleaned and lined with paper on the roof, floor, sides and doors in order to make it as nearly dirt and dust proof as possible.

"Then, the automobile is wheeled into the car and placed between blocks which prevent it from moving forward or backward no matter how many jolts or bumps may take place while the train is enroute.

"To further insure permanency of position, a spoke on each of the four wheels is wrapped with waxed paper around which a half-inch rope is slipped and then nailed firmly to the floor a few feet outside each wheel. The rope is taut and positively prevents the vehicle from side-slipping.

"We use rope for this operation instead of the customary strips of burlap because of its inelasticity and additional strength. The wax paper around the spoke eliminates any possibility of the rope marring or scratching the wheel.

"Then, a frame is built over the front of the car, from the radiator to the windshield, over which a tent-like paper covering is placed to protect that highly finished part of the automobile from dirt and dust. The frame is necessary to prevent the paper from coming in contact with and clinging to the newly painted surface.

"After this has been done a muslin covering is placed over the entire vehicle and over that goes a huge paper bag, the covering being fastened securely to the floor with strips of lath.

"Consequently when the door of the freight car is closed and the automobile starts on its journey out into the world it is as immune from dirt and dust and marring and scratching as it is possible for us to make it. And when it reaches the distributor it is in just as perfect condition as when it first left the finishing room at the factory."

"Mother of the Auto Industry"

The Cadillac Motor Car Co. traces its origin back to 1899, for it was the company organized in Detroit in that year that was later given the name of Cadillac in 1902—just 20 years ago. Thus this organization boasts a continuous steady growth of 23 years. "Mother of the Automobile Industry," is a title which is applied to the Cadillac Motor Car Co. by many veterans of the industry.

While out of this veteran company there have sprung a number of small companies, figures given out by the Cadillac Motor Car Co. indicate that the drain on its personnel has been slight and seldom. More than 500 employes have been with this company from 10 to 25 years, while more than 1,200 employes have been with the company for 5 to 10 years.

In the manufacturing organization of the Cadillac Motor Car Co. today, executives of this company state, the average length of service of foremen, assistant foremen and superintendents is approximately 9 years. A score of the employes have served from 20 to 25 years.

Automotive Industry Using 100 Percent Capacity

Predictions which many of the leading automobile manufacturers made early in the year of a great surge of spring business and even of shortage of good medium priced cars have proven true. Most of the plants are running 100 percent or close to that figure. Parts manufacturers have experienced a wonderful increase. Skilled labor is in demand and conditions bear resemblance to those which existed in 1920.

Trainload shipments are almost trailing each other out of Michigan and are being sent to all parts of the country. Dealers, who were in cramped financial condition during the winter months and as a result unable to store up any stock of cars for the spring campaign, are demanding immediate shipments to supply their needs. Many of these orders have had to be supplied only in part. Manufacturers have increased their production schedules from week to week in some cases doubling them and the outlook for May is a record production month.

Ford's Schedules

The Ford Motor Co.'s schedule for May calls for the production of 120,000 cars and additional employment of 5,000 to 10,000 men. This will necessitate the making of a car every 6½ seconds for the 27 8-hour work days. For the time being the 5-day week, which was announced a short time ago as being permanent, will have to be abandoned to meet the unexpected demand for cars from all parts. The largest number of cars ever turned out before was in August, 1921, when 109,000 were produced. April's schedule calls for 101,164 cars, which is 10,000 more than in April last year and the largest April production the company has ever experienced. The schedule will be exceeded.

Packard

The Packard Motor Car Co. has placed upon the market an improved single-six with a 7-inch larger wheelbase and it is meeting with immediate success. Although only announced the last week in April the company within a week received orders from New York, Chicago, Boston, Detroit and Cleveland of over 100 cars from each city. Dealers have made deposits on close to 5,000 cars. Production at the factory has been put on a capacity basis. and with the business on hand can continue to run so for at least five months, according to President Macauley.

Buick Increases

President Basset of the Buick Motor Co., Flint, announces that the production schedule for the Buick factory for the second quarter is 27,000 cars. This is an increase of 40 percent over the first quarter which was considered exceptional and is an increase of 8,000 cars over the second quarter of 1921 and within 2,000 of the record breaking quarter of 1920.

The Hudson and Essex Co. has been employing more men and are turning out close to 250 cars daily. Orders are already on hand calling for capacity output for May, June and July. Officials say this means in excess of 10,000 cars for the second quarter this year. In 1920, when the top of production was reached only 7,000 cars were manufactured in the second quarter.

Large Sales

Sales records for the Hupp Motor Car Corp. for the first quarter of 1922 show an increase of 172 percent over the previous largest quarter in the company's history. March with shipments of 3,005 cars from the factory, shattered all of the company's previous monthly records. April production will exceed this number by close to 1,000 cars. April 17, 215 cars were shipped, a record for day production. Charles D. Hastings, president and general manager of the Hupmobile corporation says, "The most encouraging feature of the entire situation lies in the fact that the increased sales are confined to no single locality. The impetus in buying extends all over the country with the possible exception of some of the cotton states of the south. Such a situation can only mean that there has been a radical improvement in the country's economic aspects and I expect the astonishing business of the first quarter to be grealty surpassed in the second."

Lincoln Cars

The Lincoln Motor Car Co., lately acquired by Henry Ford, is steadily increasing its production with close to 50 cars being turned out daily at the present time. Mr. Leland, president of the company, reports that orders on hand would justify the doubling of this amount but changes in equipment and methods of production which are being installed are holding back production for the time being. The schedule is being gradually increased, however, as witnessed by the fact that a month ago only 25 cars were being made daily.

Competition for Ford

The new Durant Star car, which was announced some time ago as a competitor of the Ford and which will sell for $385, will be in production the latter part of June on a small scale with a daily production of 200 cars planned for the first of September. The motors for this car are at present being produced by the Continental Motor Corp., Muskegon, which is working at full capacity, having put on a night force a couple of weeks ago.

The first shipments of the Gray car will be made from the Gray plant, Detroit, the middle of next month. The 1922 production schedule calls for the making of 22,000 cars and plans are being made to double this if possible. Mr. Klingensmith, president of the company, reports that orders for 200,000 cars have been received from all parts of the world, including Palestine, India, Egypt and Africa, but all have had to be refused for the time being as only domestic orders can be filled this year and these only in part.

Automobile Parts

So rapidly has the demand increased that many kinds of material are impossible to obtain. Delay in delivery of closed car bodies has placed Ford closed car deliveries 30 days behind orders. Axle deliveries are in a like condition. The Timken Axle Co. is making 500 passenger sets a day, the top capacity of the plant, and is taking orders subject to 60 days' delivery. Improvement in the truck manufacturing field, which has been practically dead for the past year, is seen in the demand for 1,500 axle sets a month. The Gemmer Manufacturing Co., Detroit, makers of gears, reports that its present capacity of 1,000 gear sets a day could be increased 50 percent if material was available.

Wifie—"Oh, John, dear! Cook has been awful today. In fact, she has broken off all diplomatic relations, issued an ultimatum, and demanded her passport."

Predicts Closed Cars Will Lead in Production

"Within the next three years the production of closed cars will equal that of open types and in six to eight years I believe at least 75 percent of the production of the motor car manufacturers of America will be all-season types."

That is the rather startling prediction of H. H. Buggie, vice-president of the Dura Co. of Toledo, manufacturers of window regulators for closed cars.

This statement is based on developments and trends in the industry since 1915, trends which in the last three years have been so marked as to make the prediction an obvious conclusion.

"Public demand and good manufacturing judgment are bringing the change about," Mr. Buggie continued. "Taking all cars as a whole the production of closed cars amount to 25 percent of the total. In the higher priced class of cars, the production of closed types was 40 percent of the total production. I know of one instance, a company with a large output, whose closed car program this year calls for 56 percent of its production.

"Back in 1915 the closed car production represented only 1.5 percent of the total of passenger cars. There was little change even in 1916. But in 1917 the decided change of public opinion in favor of the all-season type was marked, having advanced to 4 percent.

"In 1918 it advanced to 7 percent. It reached 10 percent in 1919 and 18 percent in 1920. In 1921 a quarter of the production of passenger cars of all price classes was of the closed type.

"Figures seem to indicate that closed types even now in the high priced cars are almost on an equal footing with the open types in popularity. In the $2,000 to $3,000 class the production of closed types in 1921 was 36 percent of the whole; $3,000 to $4,000 class, 41 percent and cars of $4,000 and over, 47 percent.

"In cars costing $1,000 and less closed car types increased from 1.4 percent of production in 1915 to 21 percent in 1921 and approximately 25 percent this year. These figures show positively the trend of public opinion.

"The change now going on in favor of closed types is of greatest importance to the industry as sales figures show. Up to now the automobile business has been more or less seasonable in character.

"In the late summer and fall and winter, the open car production has been at its worst. But figures on closed cars show that for 10 years, dividing the year into quarters, there has been very little variation in quarters—not more than 10 percent.

"In other words, the closed car program means comparatively constant production for the automobile factories of the country. It means, too, better operating conditions in all factories of the country.

"The public view-point on the closed model has changed. No one would tolerate for a minute a temporary top on a Pullman train and very little of the luxury of our modern Pullmans would be possible with such a top.

"And the comparison is not as ridiculous as it may seem. The automobile of today travels as far and as fast, if you like, as the ordinary Pullman. And to the man who cannot afford the luxury of two cars, the closed type offers the widest range of service, the greatest degree of luxurious comfort, and the most convenience for every business or social or recreational purpose.

"In the old days the closed car was looked upon purely and simply as a winter car because of the protection it afforded against snow and cold.

"Today, however, the comfort which the closed car affords, the growing appreciation of its desirability as a protection against dust, dirt, wind and rain as well as snow and cold, has made it the ideal car for every motoring purpose.

"Seventy-five precenet of all of the cars in use are owned north of the Mason and Dixon line, a country marked by inclement weather and subject to sudden and violent changes on an average of 12 to 14 days a month with sunshine less than 60 percent of the year, according to government estimates.

"This climatic condition constitutes a vital reason for the popularity of the closed type but its strongest appeal today is that it sacrifices none of the really worth-while advantages of the open car."

American Cars at Netherlands Auto Show

The thirteenth annual exhibition of motor vehicles at Amsterdam, under the auspices of De Dijwiel en Automobiel Industrie Association of the Netherlands, was the largest and most important show of its kind ever held there.

There were about 150 cars exhibited, representing 42 different makes—the United States leading with 16, France following with 12, Germany with 11, Great Britain with 2, and the Netherlands with only 1. The medium and small type cars were the most popular, as prices are almost double those in effect in the United States at the present time. Dealers in the lower-priced cars state that sales were far above expectations, and it is estimated that 75 percent of the cars sold were of American make. The greatest number of sales was made by the distributor of a low-priced American car, who gave an exhibition of step climbing, the most conspicuous event of the show.

While over 40 percent of the motor cars of the Netherlands are of American make and the percentage is likely to increase, as shown by the exposition, it is felt that still greater sales could be made if the price of American cars in the Netherlands could be reduced. This might be partly effected if American manufacturers would change their policy of requiring agents to pay in full for cars before they are shipped from the United States—an item which adds considerably to the selling price of our goods abroad. Both this item and the heavy freight charges serve to raise the price of American cars far above the prices of competing European makes, which have a negligible freight charge and are sold on credit to the dealers.

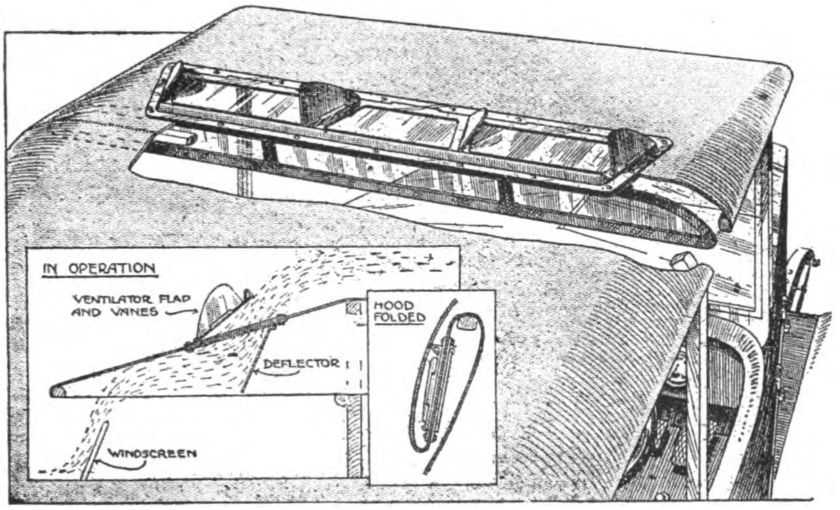
Four of the 40 motor cycles exhibited were American makes, which are considered without equal—in the Amsterdam district, at least. Only a few American accessories were shown.

Motor Transport in Belgium

Approximately 10 percent of the 30,000 motor vehicles in Belgium are trucks, the use of which for city delivery purposes has been steadily increasing during the past two years. Probably a quarter of these trucks are used with four-wheeled trailers in Brussels and Antwerp, and some are used for heavy hauling around Liege and Ghent. Motor trucks for use in Belgium should be equipped with extra-good brakes, as there are sharp grades and long climbs in addition to narrow and winding streets in nearly all the above-mentioned cities.

An Effective Ventilator Which Deflects Air Through Top of Hood

Not a few cars are provided with windscreens, whether of the single or of the double-panel variety, which, when the hood is raised, cause an unpleasant draught to impinge upon the back of the needs of those occupying the front seats. One of our sketches shows, by means of

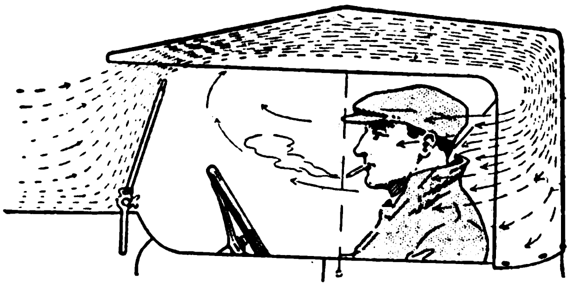


A composite sketch, showing the ventilator in place above and slightly in front of the driver's head; also, a sectional side view of the ventilator and the manner in which it lies when the hood is folded down.

dotted lines and arrows, the air stream resulting from the forward passage of a two-seater with a single-panel screen, and, with certain minor differences, the path of the air is very much the same in the case of many fourseaters when the hood is raised.

E. L. Ford, England, has designed and constructed an ingenious automatic draught-preventing ventilator, of which we reproduce several sketches from Autocar, one showing a complete ventilator in place on the hood, another a diagrammatic side view indicating how the air stream escapes through the ventilator, and a third representing the position of the ventilator when the hood is folded down.

The illustrations are practically self-explanatory, but we may mention that by means of the downward and forward sloping deflector the air stream above the driver's head is intercepted and thrown upward against the under side of a flap let into the top of the hood. This flap is hinged along its forward edge, and, being very light, it is lifted automatically by the pressure of the air below it.



In a two-seater with a single panel windscreen the draught-producing air stream follows the lines indicated by the arrows.

In the larger illustration it will be seen that small vanes, set at an angle to one another, are provided along the top of the ventilator flap, and the inventor claims that the shape and position of these vanes, together with the turned-over rear edge of the flap, render it impossible for any wind to pass through the ventilator from the upper to the lower sides.

Mr. Ford states that the effect of his ventilator is altogether remarkable in the way of preventing back draught for the front seat passengers, and he also says that his device can be fitted very easily to existing hoods. It is claimed that the ventilator is equally useful in the case of a double-panel screen when the upper panel is opened in a forward direction, since then the air stream passes through the aperture between the panels and upper panel, so that it comes in contact with the deflector of the ventilator.

This invention has passed beyond the experimental stage, it having been installed by Mr. Ford with excellent results on one of his own cars. The position of the ventilator above the driver's head was arrived at after lengthy trials, the object being to ascertain which was the best spot for the release of the air stream beneath the hood. The lifting flap of the ventilator has its lower edge lined with rubber or felt, and Mr. Ford says that it is almost inaudible in action.

N. A. C. C. Studying Utility Question

A thorough study of the question of automobile utility has been undertaken by the National Automobile Chamber of Commerce, which believes that, in spite of previous investigations by various authorities, the real facts have never been properly approximated. Business and pleasure uses of the automobile have been contrasted in the past, but it is believed a new distinction should be set up between useful employment of the car, whether for gain, convenience or time-saving only, or for purposes of pure recreation. Questionnaires are to be broadcasted, which it is expected will show the latter class of service to constitute an exceedingly small portion of the sum total of motor mileage.

West African Auto Market Promising

British and French West Africa are importing trucks to a considerable extent and while money at present is scarce, importers are prepared to do business. Trucks are used in collecting the raw products and transporting them to the railway, river, and shipping stations, and for the distribution of imported goods. The seaports have begun to use trucks almost exclusively for hauling instead of the old method of head carriage. The ½, 1 and 1½-ton trucks are preferred. In most of the colonies heavy trucks are prohibited by law.

Freight Costs Less on Wheels

The Southern Pacific R. R. and its connecting lines have authorized a reduction in the rates of automobile wheels and spokes, on request of Memphis wheel manufacturers. The reductions apply to rates on these items on Pacific coast points. On automobile wheels, spokes, spiders without hubs or rims, etc., the rate will be $2.25½ from Memphis to California per 100 pounds. On the same commodities to Northern Pacific coast points the rate will be $2.33½ per 100 pounds.

Auto Exports Increase During March

March exports of automotive products showed an increase of 38.9 percent in value over the previous month, which is especially remarkable after the 23 percent increase in February shipments over those of January. Passenger cars gained 44 percent in number and 49.8 percent in value, while motor trucks increased 29.9 percent in number and 41.4 percent in value. Parts for cars showed an increase of 26.7 percent. Motor cycles were exported to the number of 1.573, with a value of $402.039—a gain of 59 percent in number and 55 percent in value, while parts for motor cycles increased 48.2 percent.

Our leading markets for passenger cars were practically the same as in the two previous months, Canada taking 867 cars, valued at $928.359; Australia, 786, valued at $620,729; and Mexico 596, valued at $434,505. Belgium, however, fell from fourth place to fifteenth, importing only 58 cars, as against 364 during February. The United Kingdom took 247 cars, valued at $192,842, an increase of 215 cars over the number imported in February. Argentina, British South Africa, Cuba, and Japan were the next important markets, in the order named—all having imported over 150 cars.

Japan was the leading market for motor trucks, having imported 119, valued at $86,731. Canada followed with 110 trucks, valued at $162.904. Although Mexico took the greastest number of trucks in February, it fell to fourth place in March, importing only 35 trucks, at a value of $37,446.

Spring and Axle Shipments Gain

F. L. Martin, sales manager of the Sheldon Axle & Spring Co., Wilkes-Barre, Pa., recently returned from a business trip through Texas and the northwest and reports a noticeable improvement in conditions. There is greater activity in the oil section of Texas, and renewed interest is evident in Minneapolis and St. Paul as well as other parts of the northwest in motor busses. Contractors and manufacturers of heavy merchandise are buying trucks in Chicago. The Sheldon factory is running a night shift in some departments. April figures will show that the shipments of springs for motor cars were more than 100 percent greater than in March and springs for motor trucks nearly 100 percent greater. The output of axles for motor trucks will be almost double the shipments made during March.

Light Cars Most Serviceable in South Africa

It is estimated that there are about 21.214 passenger cars, 952 trucks, and 11.630 motor cycles in all South Africa. A majority of the passenger cars are found in the towns, Johannesburg alone having over 3.000. Lightweight cars are the most serviceable to farmers and others living in the rural districts, because of bad roads outside of the urban centers. About 55 percent of the cars in South Africa are made in the United States, and an additional 30 percent are United States manufacturers' cars made in their Canadian factories.

There are 114.325 persons engaged in road building work. There are 80,000 federal, state, town, and county highway officials; 7,000 road contractors; 2,000 bridge contractors; 15,000 civil and highway engineers; 10,000 automotive and chemical engineers, and 325 geologists.

Taxable Horsepower on Autos in Denmark

The internal Danish motor tax is based on the formula: One horsepower equals 0.3 times the number of cylinders times the square of the more (in centimeters) times the stroke (in meters). A graduated tax of between 12 and 50 crowns per 100 kilos weight of the car is assessed according to the taxable horsepower, with a minimum tax of 50 crowns on passenger cars. Trucks are taxed by a flat rate of 20 crowns per 100 kilos weight of the car for pneumatic-tired trucks and 30 crowns per 100 kilos weight of the car for solid-rubber-tired trucks. Ten taxable horsepower equals about 30 American horsepower.

Federal Department Filming Auto Industry

Advertising of the American automotive industry by moving pictures will be accomplished in less than a month, according to the Department of Commerce. Actual work of filming the industry, the department announces, has already begun, under the immediate supervision of Morton F. Leopold, engineer in charge of motion picture activities of the Bureau of Foreign and Domestic Commerce.

The film, which will be called "The Story of an Automobile," is being made at the plant of the Studebaker Corp., at South Bend. When completed it will be taken to Washington and reviewed by a board composed of government engineers and other representatives of the Department of Commerce, who will pass upon it before giving it the government's official endorsement.

Distribution of the film will be entirely under government supervision. Fifty copies will be released simultaneously for showing in South America, Australia and Africa, these being considered by the government as being the most potential fields for automotive export business. Arrangements have been made to show it in Rio de Janeiro during the World's Fair to open there this fall.

Hundreds of scenes are being taken both inside and outside the factory. An airplane was brought from Chicago to film exterior scenes, in order to give a bird's eye view of the magnitude of a modern American automobile plant. At all times a government check will be made on titles and quotations.

Automobile Production

Production of the Ford Motor Co. in April is reported at 127,249 cars and trucks, which constitutes a new high record in achievement. It is expected that this figure will be exceeded in May, with a production now estimated at 135.000 vehicles. Total sales by the General Motors Corporation are reported for the first four months of 1922 at 111,960, as compared with only 46,649 vehicles in the first four months of 1921.

With returns complete except for a few small companies, the Department of Commerce reports, for identical companies, the following output during the first four months of the year:

	Passenger Cars	Trucks	Total
January	81.638	9.204	90,842
February	109.039	12.968	122,007
March	152.647	19,449	172.096
April	196.512	21.944	218,456

There is something wrong with the business ability of the man who cannot see today a better way that he might have done yesterday's business.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Allyne-Zeder Motors Co., Cleveland, which will be formed by a re-organization of the Cleveland Tractor Co., will manufacture six cylinder automobiles in addition to tractors. It is stated that approximately $5,000,000 will be added to the assets of the Cleveland Tractor Co., forming a corporation with a capital stock of $10,000,000 preferred stock and 200,000 shares of no par common stock. Clement Studebaker, jr., will be chairman of the board, and other officers will be Rollin H. White, president; R. I. Hodgkins and George M. Studebaker, vice presidents; George K. Knobloch, vice president and works manager; F. M. Zeder, vice president and chief engineer; C. D. Fleming, treasurer, and E. B. Wilson, general sales manager.

Aluminum Manufactures, Inc., which has four plants in Cleveland, has completed six automobiles of a new design and for some weeks has been subjecting them to the most rigid tests. Aluminum is to be used largely in the manufacture of the engine and the body. It is claimed this material will give lightness and strength. No statement as to when production would be commenced could be obtained at the plant of the company. E. E. Allyne and R. H. White, directors of Aluminum Manufactures, Inc., have been prominent in promoting the reorganization of the Cleveland Tractor Co., which will build the new Zeder car.

Bethlehem Motor Corp. plant at Allentown, Pa., which has been operating under a receivership, has been purchased by Howard B. Hall, former vice president of the company, at a public sale for $550,000. Plans are under way for a reorganization of the company with Mr. Hall as president and general manager, and the rehabilitating of the plant to manufacture motor trucks. The Pottstown works of the company will also be acquired and operated. Arthur T. Murray, former president of the company, and now head of the American Bosch Magneto Co., Springfield, Mass., is interested in the reorganization.

Frontenac Motor Co. of Am., Inc., 37 Wall street, New York, has bought the former plant of the Federal Motor Co., at 15th street and the Big Four railroad, Indianapolis, and will at once equip it to manufacture the Frontenac automobile. It was recently incorporated under Delaware laws with $1,000,000 capital stock. Allan A. Ryan is chairman of the board of directors and William N. Thompson, president Stutz Motor Car Co. of America, Indianapolis, is associated with Mr. Ryan. The company has been occupying temporary quarters at 410 W. 10th street, Indianapolis.

Monroe Automobile Co., Indianapolis, has been incorporated with a capitalization of $500,000. William Small is president and general manager, and J. H. O'Brien vice president. The company is the successor to the William Small Co., which formerly manufactured the Monroe car. It has plants in W. 11th street and Fulton street and a sales and service building at Capital avenue and North street. In addition to the two officers the directors are F. A. King, J. C. F. Martin and H. H. Alexander.

Winther Motors, Inc., Kenosha, Wis., which erected a new factory group costing $250,000 the past year, following the consolidation of the Winther Motor Car Co., Kenosha Wheel & Axle Co. and Marwin Truck Corp., will place the new plant in operation immediately. It has taken an order valued at $2,000,000 calling for 1,000 taxicabs complete, for the Universal Motor Owners, Inc., Chicago, for delivery between June 1 and Dec. 31. Martin P. Winther is president and general manager.

Torbensen Axle Co., Cleveland, has been reorganized by local interests, headed by J. O. Eaton, former president and general manager of the company. Mr. Eaton and his associates constitute practically the same group of men who for a long time had control. They have again acquired control through the purchase of the interest held by the Republic Motor Truck Co. The Torbensen company was organized in Newark, N. J., in 1911, and moved to Cleveland in 1915.

U. S. Tractor & Machinery Co., Menasha, Wis., expects to let contracts about May 15 for the erection of a new gray iron foundry to cost about $50,000, and extensions to the machine shop and assembling floor. It has placed a new issue of $250,000 in first mortgage bonds to cover the improvements and accommodate the growth of the business. J. M. Robinson is president and general manager.

R. H. Long Co., Framington, Mass., which has been making bodies for a number of years, has begun the manufacture of cars. Production started on the machines last November, and between 1,000 and 1,500 cars are scheduled for the first year. They are being marketed under the name of Bay State, capitalizing their home.

Saxon Motor Car Co., Detroit, has leased the plant of the Apex Motor Co., Ypsilanti, Mich., for three years, with option to purchase. Initial production will total about 15 cars per day and employment will be given to about 200. The company has removed its Detroit works and executive offices to this location.

Hudson Motor Car Co. and **Essex Motors,** Detroit, will be consolidated in the new Hudson Motor Car Co. by the terms of the amended articles of incorporation filed with the Michigan Securities Commission, under which the company is incorporated on a basis of 1,200,000 shares of no par value common stock.

Auto Collapsible Rim Co., Detroit, care of Peter R. Rossello, 406 Congress building, architect, is having plans prepared for new eight-story works, 110 x 160 ft., on Bellevue avenue, for the manufacture of metal rims for automobile wheels, estimated to cost about $500,000, including equipment.

Richelieu Motor Corp., 649 Mattison avenue, Asbury Park, N. J., is considering the purchase of property at Rahway, N. J., for the establishment of a plant. Samuel A. Reeves is president. The company was incorporated recently with a capital of $2,000,000 to manufacture automobiles.

Durant Motor Co. of Michigan, Lansing, has awarded contract to the Christman Construction Co., Lansing, for the erection of two new units to double approximately the present capacity. A large part of the new buildings will be given over to the manufacture of the Star automobile.

Fox Motor Car Co., Philadelphia, Pa., has decided to start producing the Fox car during the next 90 days. The machine, which is a high-grade air-cooled job, was exhibited last winter at the various shows, and will be available to the trade and the public early in the summer.

Associated Motors Corp., Louisville, is perfecting plans for a merger with the Kentucky Wagon Mfg. Co. The consolidated company will have a total capitalization of $50,000,000, and plans for increased facilities for the manufacture of motor trucks and automobiles.

Rubay Co., Cleveland, is about to manufacture an automobile that will have as distinctive features in its chassis as those which have been incorporated in bodies which

(Continued on Page 32)

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

A. C. Webster, chief of the cold heading plant of the Ford Motor Co., at Highland Park, Mich., has resigned. He has not announced his plans for the future. Webster is generally credited with the successful development of the cold forging and heading process for working alloy and high carbon steel, and during his five years as head of this work for the Ford company was responsible for many important developments in the art.

W. H. Wilson has been appointed works manager of the Prudden plant of the Motor Wheel Corp., Lansing. Wilson has been identified with the automotive industry since he helped to build the first three cars turned out by Oldsmobile. He later became chief inspector at Olds, and subsequently was with the Cadillac and Leland organizations. Following the war he returned to Cadillac and then went to the Elizabeth plant of the Willys Corp. He left Willys to join Motor Wheel.

Hargrave A. Long has again become general manager of the recently reorganized Wood Wheel Manufacturers Association with headquarters in Chicago. Long became manager of the industrial group department of the Motor and Accessory Manufacturers Association when the Wood Wheel Manufacturers were taken in as a group, but retired when the M. A. M. A. decided to abandon its group activities.

R. M. de Vignier has resigned as chief engineer of the American Vulcanized Fibre Co., Wilmington, Del. de Vignier was connected for many years with the Western Electric Co. and the duPont company as development engineer and also produced the Mercury passenger car, work on which was stopped at the opening of the war. He has not yet announced any definite plans for the future.

George L. Lorch, superintendent of the Eagle Manufacturing Co., Appleton, Wis., manufacturing Eagle tractors and power farm tools, has resigned to accept a similar position with the U. S. Tractor & Machinery Co., Menasha, Wis., manufacturing Uncle Sam tractors and now engaging also in the production of tractor implements and power farm machinery.

J. M. Crawford, who has been chief engineer in charge of manufacturing for the Allen Motor Co., Columbus, has resigned, due to the postponement of the sale of the company from April 18 to June 6. Before taking up his work with the Allen company Crawford was connected with the Chalmers Motor Corp. as assistant engineer.

Elwood Haynes, president of the Haynes Automobile Co., has been awarded the John Scott Medal, certificate and premium "for his discoveries in stainless steel, stellite and chromeiron," according to an announcement by the faculty of Worcester Polytechnic Institute, from which Haynes was graduated in 1881.

R. A. Flum of Cleveland has been appointed general factory manager of the C. G. Spring Co., Kalamazoo. He held a similar position years ago with the Perfection Spring Co. of Cleveland, and goes to Kalamazoo to be associated again with his old chief, Christian Girl.

O. F. Conklin has joined the Concoran-Victor Co., Cincinnati, as consulting engineer. Conklin was formerly identified with the Remy Electric Co. as chief engineer and later as president and general manager.

A. W. Almquist has organized and become president of the Twin Piston Ring Corp., of West Orange, N. J., which is putting on the market a new "Twin Diamond" hammered ring for engines of all types. Almquist was at one time chief engineer for Thomas A. Edison.

R. H. Shartle, for several years master mechanic for the Wagner Electric Co. and previously identified with the Dalton Adding Machine Co., has associated himself with the Inland Products Co., St. Louis, as works manager in charge of factory production.

C. D. Le Fevre, formerly actively identified with the work of the Society of Automotive Engineers, has resigned to become eastern manager of manufacturers' sales of the Westinghouse Union Battery Co., Swissvale, Pa., with headquarters in New York City.

Ralph D. Mock, until recently an executive officer of the Hydraulic Steel Co. of Cleveland, has become president of the Colonial Body Co. of Boston. He was one of the organizers and is president of the Cleveland Finance Co. as well as the Metropolitan Securities Co., with which the former is now affiliated.

Luke B. McDermott, factory manager of the Franklin Automobile Co. of Syracuse, has become connected with the sales department of the Martlew-Bamerick Co. McDermott has been associated with the automobile industry for many years.

Henry S. Lord, vice president and treasurer of the Moline Plow Co., has resigned his position after an association with the company covering a period of ten years. He has not announced his plans for the future.

C. K. Lassiter, vice president in charge of manufacture of the American Locomotive Co., has resigned, it being reported that he will head the new merger of machine tool manufacturing companies.

Body Builders

Fisher Body Corp. has plans fully made to build an addition to its former airplane body plant in Detroit, which has been practically idle since the war. The new building and its equipment will represent an expenditure of more than $2,000,000. It is of concrete fireproof construction, 1,000 ft. long with 650,000 sq. ft. of floor space, making a total of 1,282,000 sq. ft., or 30 acres of floor space for the combined unit. The completion of the new building will mean the employment by the company in its west end unit of from 7,500 to 10,000 people and within its walls every process of body building will take place from the time the raw materials enter until the finished bodies leave, ready for the chassis.

Wilson Body Co., Detroit, has taken over the business of the Henry E. Hunn Co., which for some time has been doing painting and trimming work in Detroit. Aside from acquiring the Hunn plant, the Wilson company has added Henry E. Hunn to their forces. He will take active charge of the painting and trimming work, which branch is to be concentrated in the plant at Lincoln and Holden avenues, just leased by Wilson. This latter plant was originally built for the Warren-Detroit car, and later was occupied by the reorganized Lozier company.

George W. Copp Co., Inc., the Copp Body Co. and the New York Auto Equipment Co., Inc., have been merged as the Copp Corp. with a plant in Long Island City. The consolidation provides advantages in the manufacture and distribution of the slide sedan top, taxicab bodies, closed bodies and tops made by the corporation. The company now is in a position to deliver, for example, an order up to 50 taxicab bodies mounted and painted, within one week. A fully equipped reconditioning and repair department also has been established.

Martin-Wasp Corp., Bennington, Vt., has developed a body stock sawing department within the last year. Contracts are now being carried out for production body builders for sawn stock to be used in the construction of closed jobs for Packard, Cadillac and Lincoln. The firm has developed the Martin system of pattern sawn body stock and its plant is equipped for the production of all wood pieces entering body construction, sawn and ready for final machining and assembly. Karl H. Martin is president of the company.

Dort Motor Car Co.'s body plant in Kalamazoo started work in its painting department May 1 and plans to go on full production at the earliest possible date. Robert Gladfelter, general superintendent of the body department, has been directed to maintain a schedule of 25 closed car bodies and at least 60 open car bodies through May and June. The company is advertising for men. Rumors that the company planned to sell its Kalamazoo plant and concentrate its production at Flint are denied.

Mullins Body Corp. is understood to be doing the biggest business in its history, working some of its departments three eight-hour shifts. May production calls for 7,500 sets of fenders, and it is expected that June and July will show progressive improvement. April production was 30 percent better than in March and May is running 50 percent better.

Auto Body Co. of Lansing, has contracts for the manufacture of all open bodies for the Star models built in the Michigan plant. It is reported that an enclosed body plant will locate in Lansing within the next few months. In this connection it is probable that the Durant company will be only indirectly interested.

Duncan Truck Body Works has completed the erection of a modern brick factory in New Orleans. The company plans shortly to begin distribution throughout Louisiana, Mississippi and Arkansas, according to James H. Duncan, president. Sales are made direct to truck users as well as to dealers.

Washington Auto Body & Wheel Mfg. Co., Seattle, Wash., recently organized to manufacture automobile wheels and bodies, has taken over property at 911-15 11th avenue for its proposed plant. Louis Williams heads the company; Gustave Eicks is general manager.

Cline & Hicks, auto top and body builders, Lebanon, Ind., are building an addition 64 x 120 ft. At present the firm is employing 6 men. When the addition is completed the force will be increased to at least 25. The firm specializes in bus bodies.

Fress Carriage Co., Concord street, Lawrence, Mass., is taking bids on an addition, two stories, 44 x 93 ft.

Ball Bearing Standards

As the exporting of automobiles by American manufacturers became more important, steps were taken to obtain international standardization of bearings so that bearings made by companies situated in any of the large ball-bearing producing countries, such as the United States, Sweden, Italy or Germany, would be interchangeable. Several meetings were held by the ball bearing committee of the different countries and at the two-day session on April 27 and 28 the American sectional committee on ball bearings favored adopting certain proposals tentatively agreed to by the German and Swedish ball bearing committees. These proposals will necessitate certain changes in the S. A. E. standards, but only in sizes which are used to a very limited extent. It is thus anticipated that within a short time agreement will be reached as to international ball bearing standards.

The American sectional committee on ball bearings was organized by the Society of Automotive Engineers and the American Society of Mechanical Engineers, under the rules of the American Engineering Standards Committee, of which both societies are members.

Additional Notes of Manufacturers

(Continued from page 30.)

Rubay has designed for a number of well known manufacturers in the industry.

Lincoln Tractor Co., Urbana, O., has purchased the plant of the Dauch Mfg. Co., Sanudusky, O., and will equip it for the manufacture of farm tractors. The company has a capital stock of $1,000,000. R. T. Parish is president and general manager.

Ford Motor Co., Detroit, is reported to be negotiating for a site on the Indiana Harbor ship canal, Hammond, Ind., for the erection of a large foundry to manufacture iron and steel castings. It is said that the plant will employ more than 2,500 men.

Garford Motor Truck Co., 427 W. 42nd street, New York, has leased a portion of the building on the Bridge plaza, near William street, Long Island City, from the Standard Steel Car Co. for local works.

Velie Motor Corp., Moline, Ill., has preliminary plans under way for extensions and improvements in its works. Increased capacity will be provided in the motor and motor parts departments.

Clydesdale Motor Truck Co., 437 Fifth avenue, New York, is arranging to extend the general line of manufacture at its Clyde, O., plant, for the production of a new all-steel motor truck.

Durant Motors, Inc., 1819 Broadway, New York, is negotiating for the purchase of property in the vicinity of its plant at Long Island City, to be used for the erection of an addition.

General Motors Corp., Pontiac, Mich., will build a four-story addition to the local GMC motor truck plant, designed to increase the capacity from 35 to about 100 trucks per day.

Auto Specialty Mfg. Co., St. Joseph, Mich., has revised plans under way for its new one-story plant to manufacture automobile equipment, estimated to cost about $100,000.

Petersburg Lock Rim Co., Petersburg, Ind., manufacturers of metal luggage carriers for automobile service and kindred products, will build an addition, 30 x 70 ft.

The Studebaker Corp., South Bend, Ind., will erect a four-story building, 76 x 620 ft., to cost $500,000. It will be devoted mainly to handling its foreign business.

Fremont Motor Corp., Fremont, O., has purchased the plant and business of the All American Motor Co., Chicago, and is moving the equipment to Fremont.

General Motors Truck Co., Pontiac, Mich., has arranged for the establishment of a factory branch at Dallas, Tex. H. A. Neill will be in charge.

W. G. Day, 2120 Fillmore avenue, Buffalo, manufacturer of automobile radiators, etc., is planning for the installation of new metal-working equipment.

Seasoning Wood With Ozone

The seasoning of wood is, as is well known, quite a laborious process, and to obtain a properly seasoned product requires treatment for a considerable length of time. A new process has been invented in France, which has great commercial possibilities and is already being exploited in that country. In this process ozone is used instead of air. Ozone, being intensified oxygen, brings about the changes in the wood that are associated with the seasoning process much more rapidly than they take place in the air. In fact, treatment for 20 days with ozonized air will produce a seasoned wood such as would be obtained naturally only in the course of several years. The examination of the wood under the microscope reveals the structure of the wood to be just the same as that of common seasoned wood. The treatment has no effect on the color of the wood.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

1211—The owner of an automobile repair shop in Greece desires to secure an agency for the sale of a well-known competitive line of automobiles, 2, 3 and 4 seaters of 6, 8, and 12 horsepower. Quotations should be given c. i. f. Piraeus. To arrange cash payment against documents at port of shipment. Reference.

1220—A commercial agency firm in Spain wishes to purchase and also secure an agency for the sale of automobiles and accessories, garage machinery, electric motors, articles for the construction of chassis, electrical material for garage use, and lubricating oils and greases. Quotations requested c. i. f. Spanish port. Catalogs and correspondence should be in Spanish. References.

1248—An importer in Colombia desires to secure an exclusive agency for the sale of automobiles. No reference given.

1280—A merchant in Madeira desires to purchase and also to secure an agency for the sale of all kinds of motor car accessories, machinery, iron, steel, steel ceiling, tools, water pipes, steam pipes, rubber goods, tires, and inner tubings. Quotations should be given c. i. f. Madeira. Reference.

1281—The purchase is desired by a mercantile firm in Spain of automobile accessories. Quotations should be given c. i. f. Spanish port. Correspondence requested in Spanish. References.

1285—A mercantile firm in Spain desires to secure an agency for the sale of automobile accessories, hardware, lubricating oils and greases. Quotations should be given c. i. f. Spanish port or f. o. b. American port. Correspondence requested in Spanish. References.

1299a—1299s—Owing to the lack of space a number of "foreign trade opportunities" pertaining to automotive products have been grouped and can be obtained by referring to the opportunity numbers given.

1360—The owner and manager of a garage and repair shop in Spain desires to purchase and also to secure an agency for the sale of radiator mascots for automobiles, tire covers, vulcanizers, and equipment for repairing automobile tires. Quotations should be given c. i. f. Spanish port. Cash to be paid. Reference.

1379—A firm of automobile supply dealers in Ireland desires to secure an agency for the sale of a medium-priced automobile. Reference.

1380—A commercial agent in France wishes to purchase and also to secure an agency for the sale of automobile accessories. Quotations should be given c. i. f. Havre. Reference.

1382—Inquiries have been received from firms in Spain desiring to secure the representation of manufacturers of automobiles. Quotations should be given c. i. f. Spanish port, or f. o. b. New York. Correspondence requested in Spanish. References.

1392—An importing firm in Italy desires to purchase and also secure an agency for motor and upholstery leather, patent leather for shoes, and suede calf leather. Quotations should be given c. i. f. Genoa. Terms: Cash against documents. Reference.

1506—A merchant in India wishes to purchase and also secure an agency for automobiles and accessories, agricultural implements, and small light tractors. Quotations should be given c. i f. port of India.

1510—A merchant in Spain desires to purchase or secure an agency for the sale of electrical supplies, machinery, fans, stoves, automobile accessories, etc. Quotations should be given c. i. f. Spanish port. Correspondence desired in Spanish. Reference.

1659—A mercantile firm in France, already interested in the automobile trade, desires to secure an agency for the sale of motor supplies and accessories. References.

1642—A merchant in Canada wishes to purchase a portable chemical fire engine. Quotations should be given f. o. b. port of shipment. Cash to be paid. Reference

1652—A mercantile firm in Mexico desires to purchase 6,000 to 8,000 pounds of carriage, machine, and tire bolts, of assorted sizes. Quotations should be given c. i. f. El Paso, Tex. Cash to be paid. References.

1656—There is a market in Germany for machinery and cylinder oils, and lubricating oils. Quotations should be given c. i. f. Hamburg. Payment to be made in United States currency on arrival of goods in Hamburg. Correspondence preferred in German. Reference.

1661—The representation is desired by a commercial agent in Spain for the sale of agricultural machinery and tractors.

1666—A mercantile firm in Burma, India, desires to purchase trailers for timber hauling, steam boiler-feed pumps, triplex pumps, rotary pumps, belting, and anti-friction metal and high pressure steam packing. Quotations should be given c. i. f. port of India. Terms: Cash against documents. Reference.

1673-1683—Owing to the lack of space a number of "foreign trade opportunities" pertaining to agricultural implements have been grouped and can be obtained by referring to the numbers given.

1722-1739—Owing to the lack of space a number of "Foreign Trade Opportunities" pertaining to Automotive Products, have been grouped and can be obtained by referring to the opportunity number given.

1741—An agency is desired by a merchant in Canada for the sale of patented specialties relating to hardware lines, automobile accessories, and household articles. Quotations should be given f. o. b. shipping point. Cash to be paid. References.

1754—The purchase is desired in India of light but durable crude-oil tractors, and a complete electric plant for a farm of about 1,000 acres. The power will be obtained from a hydroelectric station 5 miles distant from the farm. Work to be done by cable system. All agricultural operations will be performed, including plowing and threshing. Quotations should be given c. i. f. Indian port.

1760—A firm of general merchants in India desires to secure the representation of manufacturers for the sale of electrical goods, electric motors, motor car and cycle accessories.

1972—An inquiry has been received from a firm in Spain for an agency for automobiles and accessories, lubricants and oils therefor. Quotations are desired c. i. f. Spanish ports. Correspondence should be in Spanish. References.

2011—An agency is desired by a firm in Spain for the sale of paints for automobiles. Correspondence should be in Spanish or French. References.

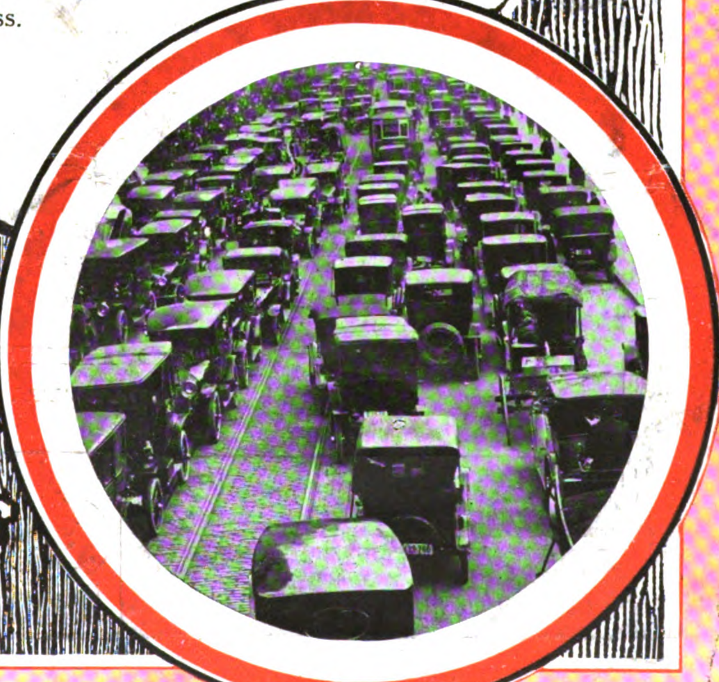
The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1, Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3, Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. XLIV. No. 3 JUNE, 1922 $2.00 Per Year Issued Monthly



Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3.

The Automotive Manufacturer

A Consolidation of The Hub and Automotive Engineering

Vol. XLIV. NEW YORK, JUNE, 1922 No. 3

The Role of the Oven in Automotive Manufacturing

How Modern Parts and Body Manufacturers Have Come to Lean Upon the Oven for Drying, Enameling, Japanning, Lacquering and Other Processes

PRACTICALLY from the beginning, automobile manufacturers have been forced to adopt the latest machinery and equipment, many times keeping one jump ahead of the manufacturers of these by suggesting desirable or desired machinery and equipment, which was later produced on special order, then duplicated, widely adopted, and finally became a more or less standard article. In the matter of heating and baking ovens, this has been equally as true as of machine tools, special steels, etc.

It was early found that a very fine and good wearing surface could be obtained on metal parts by dipping in enamel and baking. The general plan was widened by the production of special paints and varnishes, and other finishes, until today a great majority of the parts used in an automobile are finished in this general manner.

More recently, competition extending to body production on very large scales, originally considered impossible, has brought about a need for a faster process of drying bodies after they have been finished. This refers equally to the earlier coats and the later or surface finishes. It was found that a system of ovens could be arranged which would reduce the drying time practically to a minimum, and in the use of these, it was discovered further, that the use of cleaned, heated and humidified air gave a better, more even, more lustrous and more enduring finish than could be obtained in any other way.

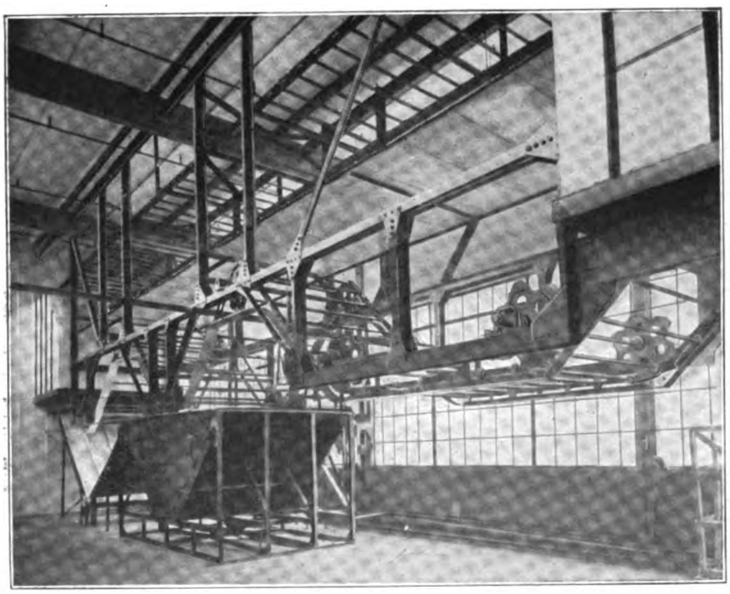


Fig. 1. Inspection station, second coat dip tank and drip, in Durant body painting system.

Considerable study has been given by a number of concerns to methods which will shorten the drying period, or in other ways reduce the length of time required for the body to have the painting and trimming operations completed. A very radical change in practice which has made possible to materially shorten this time is the discovery that it is possible to make as good if not better paint job with a considerably less number of coats than was formerly thought essential. This multi-coat is one of the direct descendants of carriage builders' traditions. Ten years ago, 35 to 40 coats were not exceptional for high-grade work. Today 13 well selected and properly applied coats are considered sufficient.

Another way in which the number of bodies, and, consequently, the amount of money tied up in bodies in process can be reduced is in the use of methods for more rapidly drying the various coats. The importance of this increased speed in drying may be realized if a concern making 50 bodies today may be taken as an example. Assuming the average time for painting without artificial drying is 24 days and the average value of the body during this period is $300, the space necessary for painting and drying would then be that required for 1,200 bodies in which would be tied up the sum of $360,000, the interest on which at 6 percent for 24 days is $1,420. If this can be cut in half by the in-

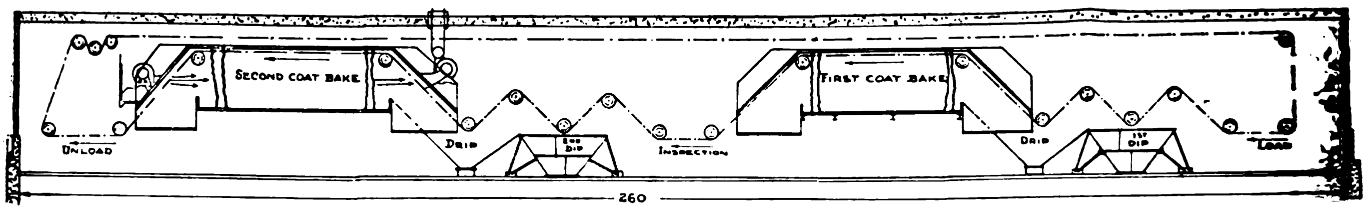


Fig. 2. Longitudinal section of the Durant installation. The two ovens are identical in construction.

troduction of a modern drying system, both the floor space and the interest on investment in bodies would be half in the saving, and interest alone would be nearly 60 cents per body. To this must be added the interest on capital invested in plants, which will, in the latter case, of course, include the drying, and from this must be deducted or added any increase or saving in operating cost.

That there is a considerable net saving is evidenced by the fact that drying systems are being extensively used and are being adopted in an increasing measure both by body and car manufacturers. This is not confined to manufacturers in any price class, but is to be found from the highest to the lowest. The principle, of course, finds its maximum economy in the case of the all-metal bodies where a thin but durable finish can be successfully baked on at high temperatures. Even with the metal body built over a wood frame, however, in which the paint coats cannot be baked at such a high temperature, it has been found possible to completely finish and trim, using a standard 12 coat schedule in 4½ working days.

One concern which has supplied a large number of ovens to automotive firms, and makers of automotive parts and supplies, is the Paul Maehler Co., Chicago, and much of what follows is a description of the ovens made by this firm. It will be interesting to describe the plants in which some of these ovens are used.

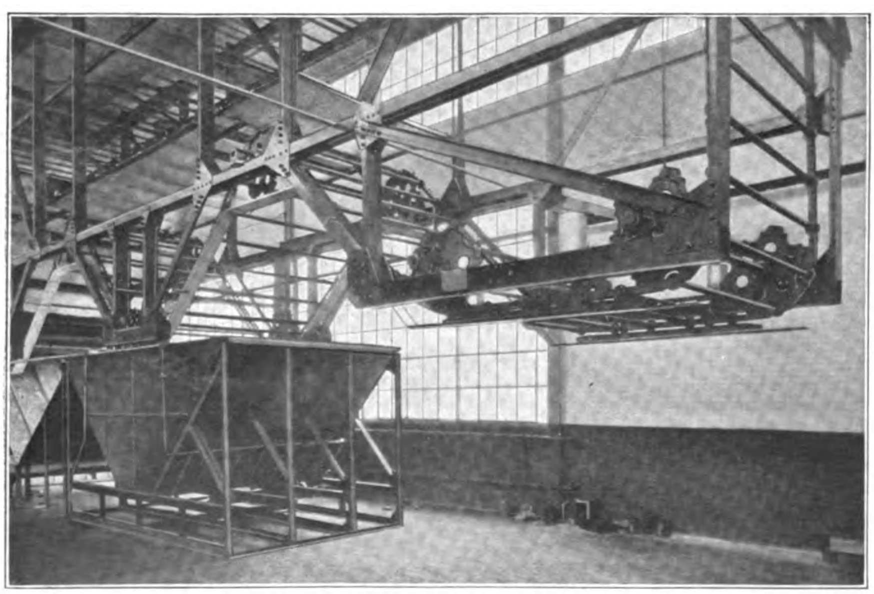
Thus, the illustration, Fig. 1, shows the inspecting station, the second coat dip tank and drip, of the Durant Motors Co. plant at Lansing, Mich. The diagram, Fig. 2, shows the layout of this plant, in which it will be noted that the installation runs for a length of 260 ft., with two identical ovens, connected only by a continuous conveyor of the link type which permits the dipping and baking of two coats on fenders and pressed steel parts for a production of 100 automobiles a day. This process is automatic and continuous, the material requiring no handling from the time it starts or is placed on the conveyor, until it is removed, fully baked, at the end of the line or unloading station. It will be noted that provision is made for two inspections, one directly after the initial coat, and the other immediately after the second coat.

The conveying system is a continuous assembly of 1,000 ft. of Link-Belt chain with Hyatt roller bearings, motive power being supplied by a 5 h.p. Westinghouse electric motor. Under test, it was found that only 2.6 h. p. was required for operation. The ovens are standard Maehler construction, such as will be described later, with 4-in. insulation, are indirect gas heated, equipped with pressure burners, automatic gas pressure controls, thermostatic temperature regulators and recording themometers. The system is being operated at a speed of 1¼ ft. per minute, at a temperature of 450 deg., and it is claimed with a fuel cost of but $21 a day.

In this plant, the loading station, and the first coat dip tank and drip are shown in Fig. 3, while the automatic regulator, recording thermometer and burner valves, previously mentioned are indicated in Fig. 4, which is an exterior view on one of the Durant ovens. Fig. 5 shows an interior view and indicates the arrangement of the indirect gas heat radiators. The unloading station and conveyor motive power installation of the Durant layout may be seen in Fig. 7.

Studebaker Oven Production for 200 Cars a Day

A somewhat different installation is that made by the Maehler company for the Studebaker Corp. at Detroit, Mich. Parts of this may be seen in Fig 6, which shows the arrangement of ovens for dipping and baking with three coats sufficient metal parts for the car production



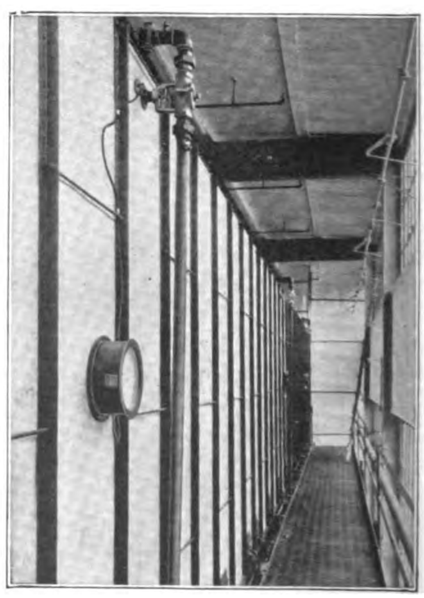
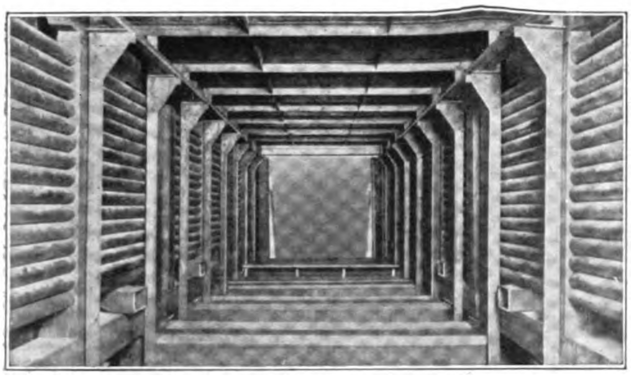


Fig. 3 (left). Loading station, first coat dip tank and drip, in Durant body painting system. Fig. 4 (right). Side of the oven, showing automatic regulator, recording thermometer and burner valves.



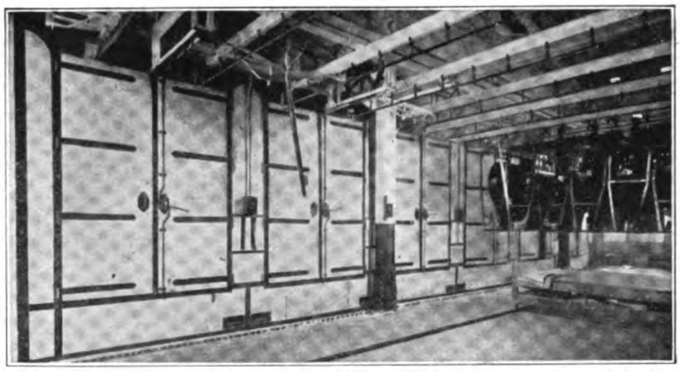


Fig. 5 (left). Interior view of the Durant ovens, showing arrangement of indirect gas heat radiators. Fig. 6 (right). Dipping and baking ovens in the Studebaker installation.

of 200 a day. In the small illustration, Fig. 8, may be noted the indirect gas radiation, by means of which these ovens are heated to 400 deg. F., the radiators showing quite plainly near the left-hand end. Another part of this installation, the dipping tanks, is shown in Fig. 9. This shows the ovens at the back, the dipping tanks in the foreground, and the drip boards between, also the overhead conveyor system, and the accessory equipment.

In this plant, with this equipment, as stated above, enough sheet metal parts are baked for a production of 200 cars a day. The installation consists of 18 ovens, 8 x 13 x 11 ft. high, built in three batteries of 6 ovens each. Mechanical ventilation, Type "B" radiators and high pressure burners are used and walls and ceilings are 4-in. insulation throughout. The ovens have doors at both ends. A system of Louden continuous overhead track with intermittent conveyors was installed from end to end of the japanning room and through the ovens. The material is intermittently dipped and conveyed progressively into each battery of ovens until three bakes are completed, when the material is discharged at the reverse end of the room.

Another automotive plant installation is shown in Fig. 10, this being the uppermost one of the group on page 11. This shows a special annealing oven built for the Reynolds Spring Co., Jackson Mich. It is used to anneal automobile cushion springs, which are loaded into baskets and passed through the oven in 15 minutes at an inside temperature of 600 deg. F. Being a more simple process, and one requiring less time, the equipment naturally does not take up the space needed for the Durant or Studebaker layouts.

Somewhat similar is the work, although not automotive in character, which is handled in the oven shown in Fig. 11, the central one of the group. This is the installation used for japanning at high temperatures on metal stampings, fire shovels and the like at the Patent Novelty Co., Fulton, Ill. The third or lower one of the group, Fig. 12, shows the multiple pass oven, electrically heated, and the removable japan tank and truck which forms a feature of this layout. By the use of a second tank in addition, it is possible to change to a different color very quickly.

Drying Is An Oxidizing Process

To return to the general process of drying as it is generally called, it should be noted that this is really a misnomer. What is called the drying action is really a chemical reaction having two periods. During the first period the volatile solvents are evaporated and during the second there is the chemical reaction of oxidation of the oils. (These oils are transformed chemically into oxides which are solid as compared with the more or less liquid form of the coat when first applied.) It has been found that the presence of moisture in the air is necessary for the oxidation or socalled drying of the coat. Furthermore, there are different ideal atmospheric conditions for each kind of coating and for different colors, while for different colors it may be necessary to have different degrees of temperature and percent of humidity in the air. Experimentation on these subjects is by no means complete, but a great deal has been learned about them and it is possible to apply the knowledge so

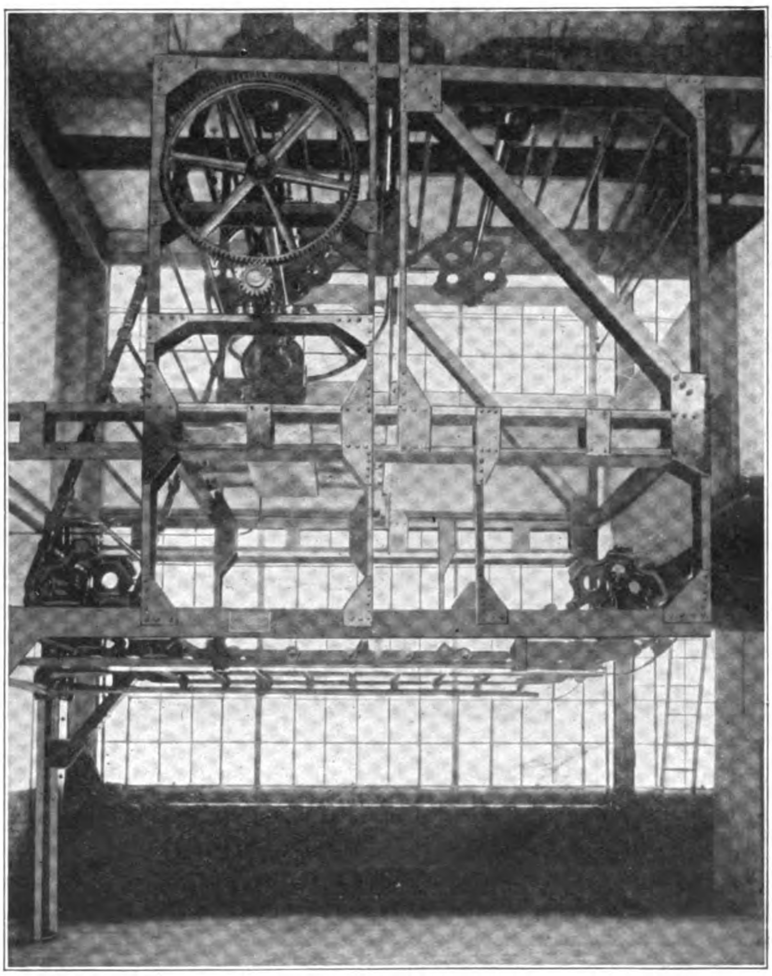


Fig. 7. Unloading station in the Du rant layout, showing above, the conveyor or motive power installation.

gained in commerical work to the extent of being able to greatly accelerate the drying of the various coats.

Moisture Essential

Probably the most difficult point for the average layman and often even the experienced finishing foreman to grasp is that moisture in the air is essential to drying. The theory of the value of the moisture content is that the moisture acts as a catalytic agent and cooperates with the increased heat in performing the chemical reaction of oxidation. The drying equipment is designed to duplicate the ideal conditions of temperature and humidity for various kinds and colors of paints. The advantages claimed for the process outside of the shortening of the drying period and consequently the reduction of the number of cars in process are the consequent reduction in the amount of floor space required to finish a definite number of jobs per unit of time, and the ability to turn out a product with an unvarying color standard.

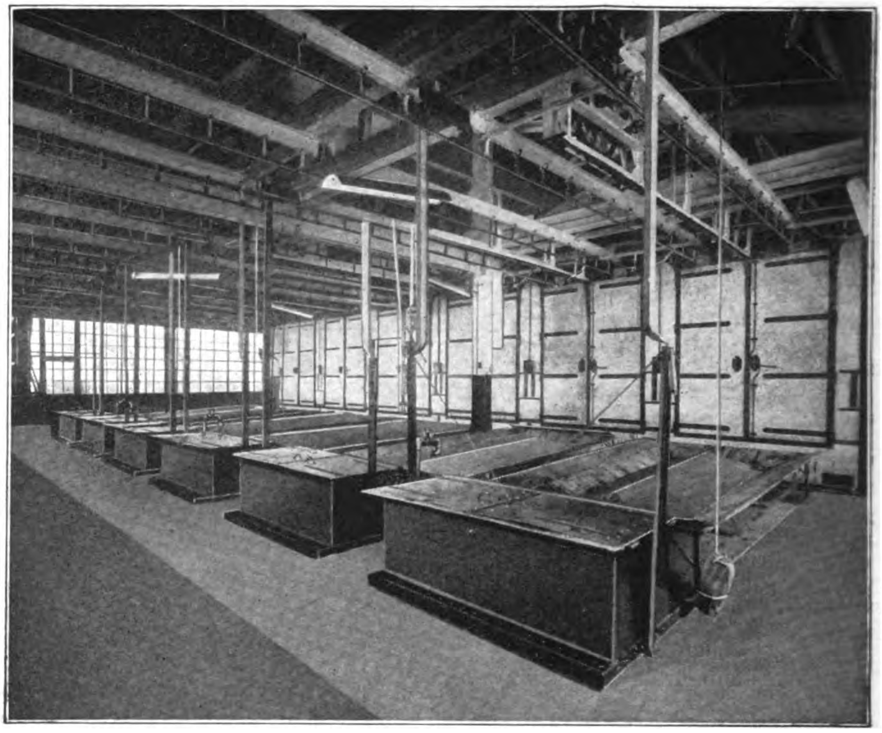


Fig. 9. One of the three units instal led by the Studebaker Corp., showing ovens, dripping tanks, drip boards, over head conveyors and accessory equipment.

In the drying of automobile bodies it is essential that the primer, lead and rough stuff coatings receive the same careful treatment accorded to the varnishes, since the strength and durability of the final finish depends entirely on the proper drying of the under coatings. In other words, the job has to be engineered from the ground up. It is just as important that the under coatings be uniform and of proper elasticity as the outer coatings, because the failure of an under coating invariably means the breaking down of the exterior finish.

In the best installations of a drying system, the under coat and color varnish operations are generally conducted in the dry rooms of a compartment type located in close proximity to the spray booth. The size and numbers of the dry rooms and ovens, of course, depend on the production requirements. In the case of touring car bodies where it is necessary to rush a large number of bodies through a small space, a material saving can be made in the dry room space by up-ending the bodies in the under coat and color varnish dry roms. It is claimed that with

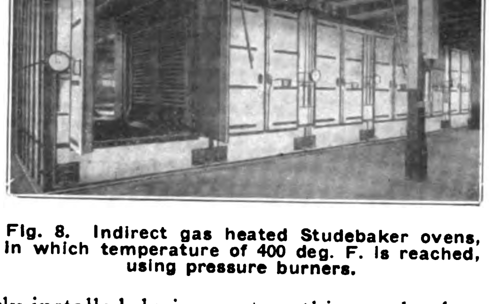


Fig. 8. Indirect gas heated Studebaker ovens, in which temperature of 400 deg. F. is reached, using pressure burners.

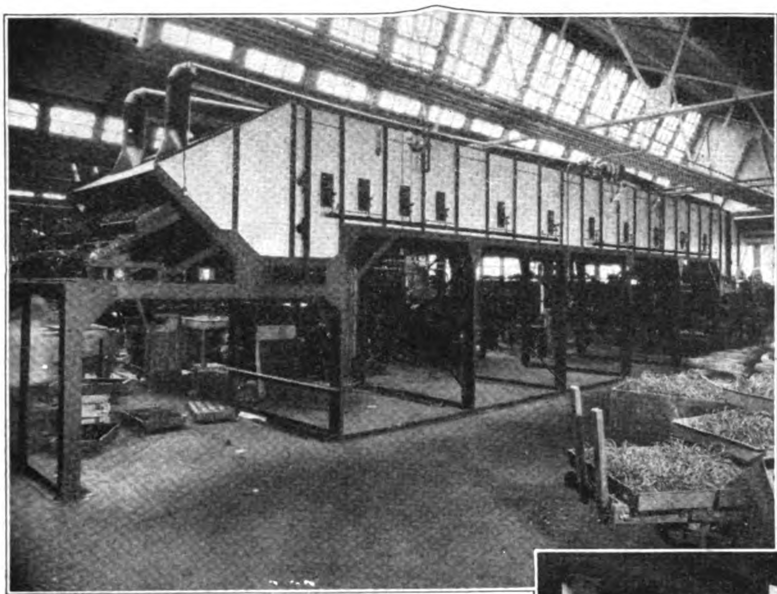
a properly installed drying system this can be done in perfect safety in the under coat and color varnish dry room. On a production job the schedule for under coat and color varnish drying periods would approximate: Primer, 2 to 5 hr.; lead, 2 to 5 hr.; rough stuff, 2 to 3 hr.; flat color, 1 to 1½ hr.; color rubbing varnish, 3 to 5 hr.

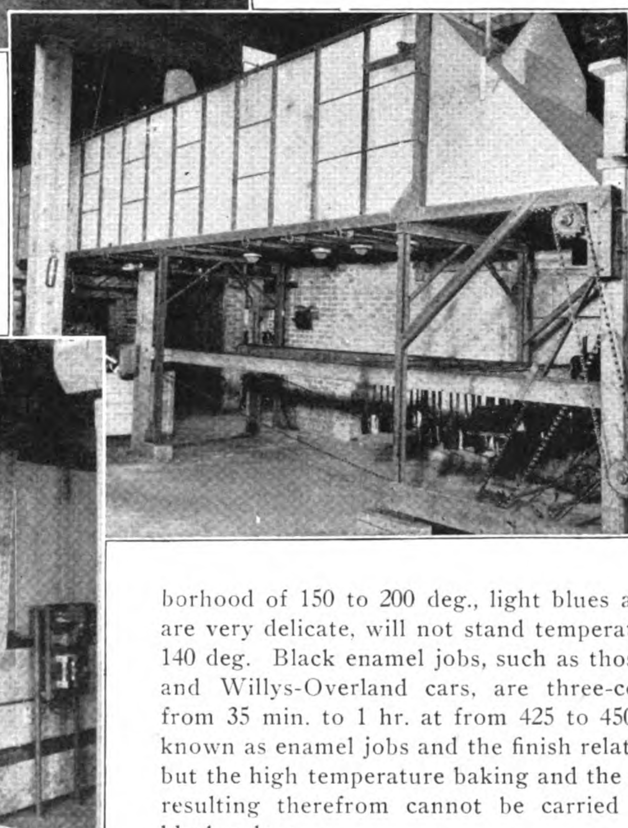
Enclosed bodies require a relatively longer time because of the great amount of woodwork and it is possible, of course, to use a somewhat higher temperature and consequently to increase the speed of drying on all metal touring car bodies.

The drying equipment furnished by Drying Systems, Inc., consists of a fan, radiator, air washer, humidifier, automatic temperature control, automatic humidity control, steam and water piping. The atmospheric air is brought out and put through the washer, which removes the dirt and humidifies the air. The heat is imparted to the air by cast iron radiators for pressures up to 30 lb. and specially designed pipe coil radiators for higher pressures. Automatic thermostatic temperature control and automatic humidity control is employed and with the installation there is a system of supply and vent ducts to produce to correct circulation of air in the drying room or oven. This is necessary to insure uniform and rapid drying in all parts of the dry room. Closed bodies are usually placed horizontally, while the open bodies are placed vertically and up-ended so as to give space in each oven for as many bodies as possible.

In chassis work the ovens can be installed along the production line so that the chasses pass through the oven on the regular assembly chain. Such an installation is shown in one of the accompanying cuts.

As regards the best layout for a paint shop, it is impossible to give an ideal condition, as so much depends on the quantity of the product which is going through. The bodies, of course, would first receive their cleaning up and priming coats, then probably a coat of lead, then a glaze and putty, the various rough stuff coats and, after that, the various color varnish and finish coats. The most efficient way of handling this is to have the bodies progressing on toward the finishing room, as each of these steps take place, so that bodies are coming out of one oven and passing on to the next, then on to the next series of op-





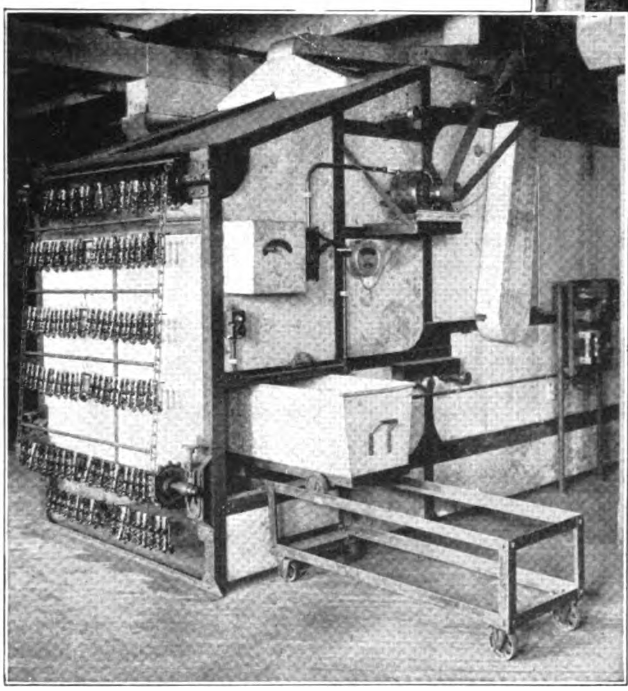


Fig. 10 (above). Three-quarters view of the annealing oven, of the elevated, continuous conveyor type, installed by Reynolds Spring Co., for annealing automobile cushion springs. Fig. 11 (side). Full type conveyor oven for japanning metal stampings, Patent Novelty Co. Fig. 12 (below). Multiple pass oven, electrically heated, showing objects on the conveyor after being baked, also electrical control devices, power plant and removable japan tank and truck.

erations in a following oven, and eventually to the finishing room. Whether or not bodies go back into the same oven depends upon the quantity of work going through and the space available.

A diagram of a proposed paint shop layout is given in Fig. 13, and it is deserving of study as a good example of what can be done to make the paint and trim work a real progressive job.

With the large number of operations on some of the higher priced jobs, the best possible speed that can be obtained is 11 days, not counting the time for trimming. Before the introduction of drying equipment, it would take from 22 to 30 days to do this same work. Lower priced cars do not have a finishing schedule nearly as long as the high grade varnishes, as, for instance, on large production schedules it is generally the practice to put on a priming coat lead coat, putty coat, two coats of rough stuff which are then water rubbed, a ground color coat, two color varnish coats which are water rubbed, and a stripe, black off and finishing coat.

In still lower priced cars where quantity production is of the utmost importance and where high quality in finish is more or less a secondary consideration, it is the practice to merely apply a priming coat, lead coat, two rough stuff coats, a ground color coat, two color varnish coats and a finishing coat. Jobs of this nature can be put through in from 4 to 5 days.

Variations

Practically every color varnish used has a different temperature and humidity at which it dries best. Green jobs, paint men say, will stand relatively high temperatures in the neighborhood of 150 to 200 deg., light blues and whites, which are very delicate, will not stand temperatures in excess of 140 deg. Black enamel jobs, such as those used on Dodge and Willys-Overland cars, are three-coated and baked from 35 min. to 1 hr. at from 425 to 450 deg. These are known as enamel jobs and the finish relatively inexpensive, but the high temperature baking and the quick drying time resulting therefrom cannot be carried out except with black colors.

The proper laying out of the paint job for efficient operation is of tremendous importance to a manufacturer of any product which has to be painted and delivered to the purchaser with a high grade finish. It is possible to spend a great deal of money in this department of manufacture and then achieve only mediocre results. On the other hand, by a careful analysis of the problem, it is possible to secure highly satisfactory results at a minimum expense and even save a considerable amount of money on the parts tied up in process in this department. When it is possible to cut a schedule from 22 days down to 11 days the money represented by the saving is considerable.

(Continued in July Issue)

Three Germans were talking together and the conversation drifted around to the second marriage of a mutual friend, when one of them remarked.

"I dell you vot! Any berson vot marries der second time don't deserve to have lost der first vun."

Greater Luxury in Motor Car Fittings

Modern Tendency Is Toward Giving More for the Money, This Extending Into Quality of Leather, Color Schemes, Hardware, Equipment, Etc.

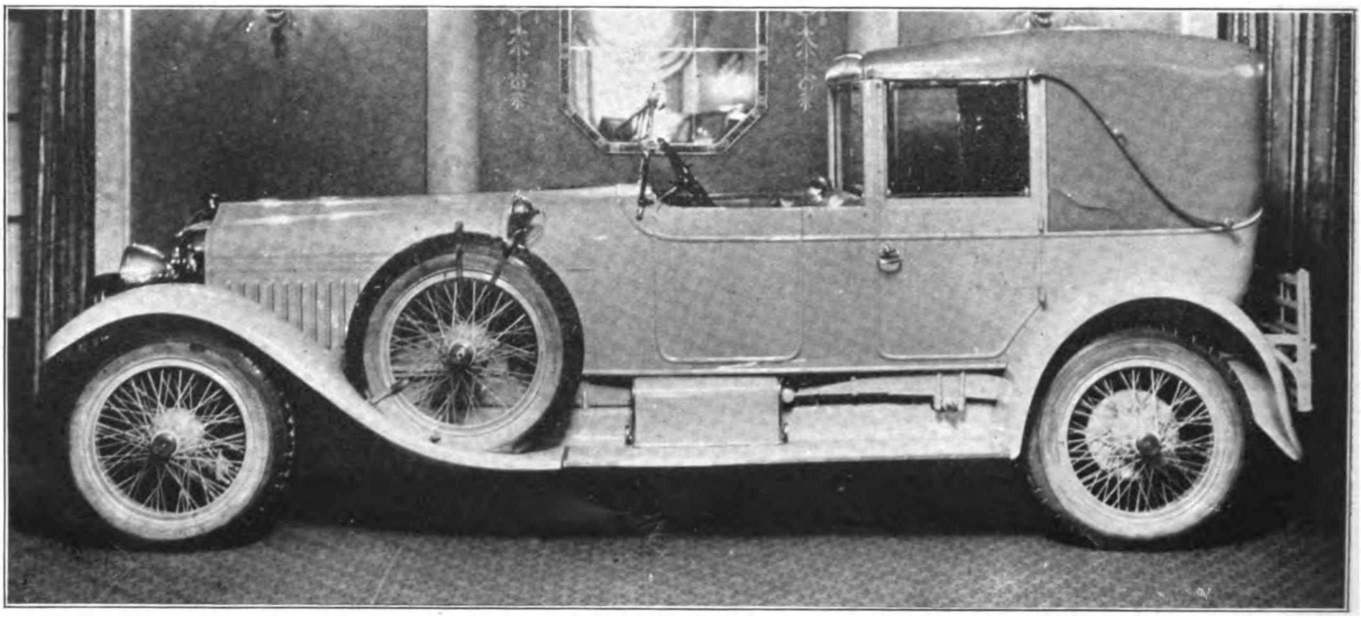
IT TAKES but a casual inspection of the modern motor car, and by that reference is had to the very latest 1922 design which is abreast of or as the publicity man would claim, ahead of the times, to discover that manufacturers are giving much greater value for the money than ever before, and that a great deal of this is in the direction of greater luxury.

Whether the influence of women in the buying of motor cars is responsible for this or not, is difficult to say with truth and accuracy but the fact remains that there is much more luxury to be had than was the case five years ago, and it is to be had combined with greater mechanical quality and reliability, and as stated, for less money.

In short the greater luxury idea has been carried clear through the car. It is not restricted to the springs of the ... seat cushions, or to the elegance of the upholstery material, but is embodied in every part of the whole car. A much wider range of color schemes is offered the prospective buyer, so that even the most fastidious feminine taste can be gratified without the need for putting through a special job. Similarly with the equipment and accessories, these are so complete as to cover practically everything a reasonable person could ask for, so that it is unnecessary to start buying, as was the case years ago, as soon as the car was delivered.

A great deal has been said, first and last, about the economic tendencies of the world since the close of the war, and especially in motor car circles, of this marked tendency in the United States because of the hard times following the war, so that designers have been charged to take this into account. They have, therefore, divided their attention between those who look upon tomorrow as another day and those who do not. It is such a joy to them to let their imaginations run riot—to produce something really new and distinctive. At first it was said that they complained a little at this new American attitude of saving for the future. They argued that the foreign designer would throw up his hands and say it could not be done—that art could not hold sway when one had to keep an eye on the expenditure, but American adaptability conquered, and the result is all that the most exacting could desire.

The producers, too, have had a hand. Perhaps it was the pinch of hard times that overcame the automobile manufacturers along with other industrial enterprises, that caused old Mother Necessity to bestir them, for never before has there been such uniformity of purpose. This year's cars show that all have been bent upon turning out the very best that the resources and their factories can produce. Even in the standard cars of less expensive makes the workmanship is far ahead of anything shown in former years. The cars priced at from $800 to $2,000 have any number of new features.



Specially built cabriolet for Marilynn Miller. Brooks-Ostruk body on a 30 h.p. Minerva chassis, a very luxurious riding job.

Many New Leathers

Take leathers, for instance. No one would have believed a few years ago that there could be such a variety. The natural assumption was that where leather had to be on a car it was, but there was little question as to what kind it would be. There was pigskin of perhaps two or three grades, and Spanish or Moroccan leather if one wanted to be really dashing. Not more than half a dozen choices in all. But now a great book of leather samples is provided. They range from the more familiar leathers to those formerly used only for milady's handbag, and some new grades, all with most intriguing new names. On the really smart car one finds very interesting combinations of these leathers, serving, in addition to a utilitarian purpose, a decorative one as well, for a clever combining of leathers is pleasing and adds to the smart appearance of a car.

But a serious rival to leather in the enhancement of the closed car is the hardware. Here, indeed, the manufacturers have shown their mettle. There is the abundant choice of bone, mother-of-pearl, ivory, Sheffield silver, brass and aluminum, or any combination of them. Cut glass is also an attractive addition to the hardware fixtures. In fact, the custom body builders have come to realize that the variety of products for these accessories has been far from exhausted, and once realizing the resources at their command have become quite reckless in turning out distinctive designs. The use of brass is perhaps the newest and most unusual departure. It gives such a lavish appearance to the car that it bids fair to be extremely popular. One smart town car seen recently had the entire hood of brass, which was also used liberally in the trimming and hardware.

Many motorists have found that sheet aluminum makes a very fetching new material for the adornment of the car. By replacing the usual sleekly-painted or enameled hood with a new one of sheet aluminum not painted but simply polished enough to eliminate all surface roughness, the car is given a sportive appearance, a shine which catches and holds the eye as well as either polished brass or the liberal use of nickel plate, and a clean, cool look as well.

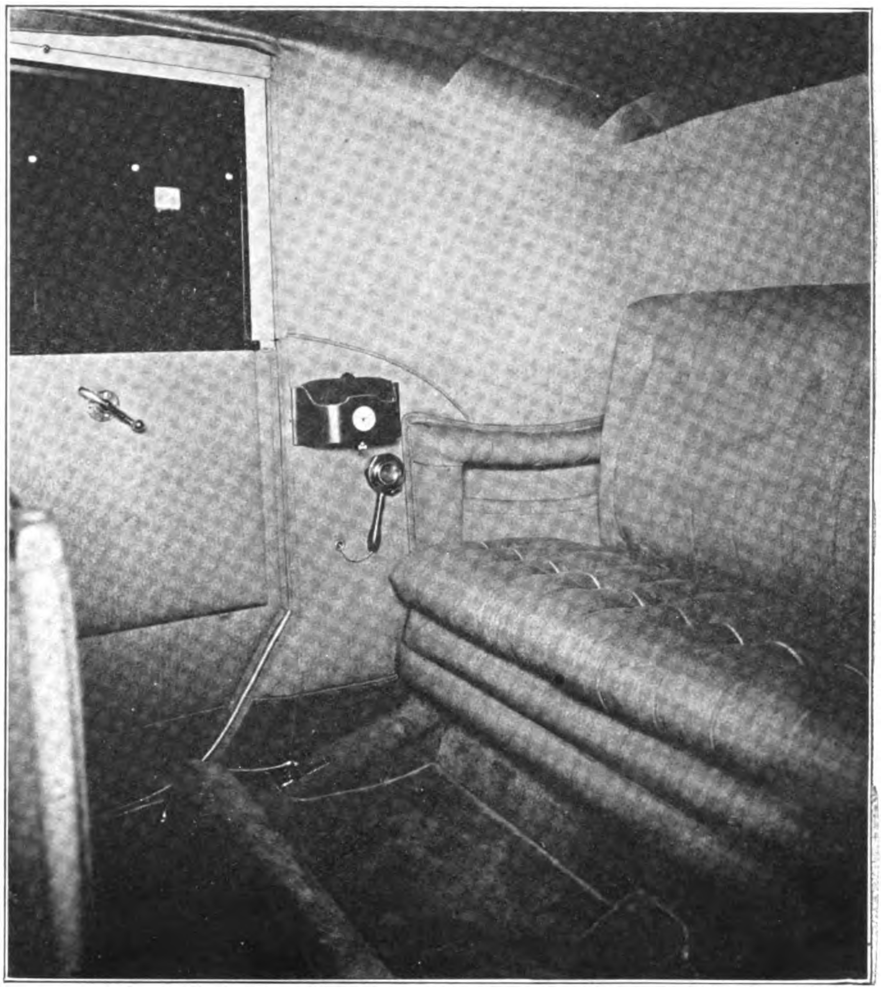
When brass is used for the hood and other parts of the front end of the car, old ivory striping, edging or painting is used, the creamy tint of the latter blending beautifully with the gold. One such car, which was hung very low, was painted a soft French blue, which was further set off by the deep tan interior. Another car seen on the streets of New York is of delicate gray, with the interior of the same tones and fittings and hardware of solid silver.

Bright Tints Favored

The sombre tones so much in favor during the past few years seem to have lost caste. The smart cars are painted in brighter tints and the interiors either match them or are of contrasting shade, but equally bright. No longer does milady choose her motor car with neutral tones so that the interior will match any gown she may wear. A car is much too important in her life to have it an uninteresting means of transit. It is now selected with greatest care, and, if need be, her gowns are made to fit the car. After all, the smartly dressed woman favors a certain color during an entire season. It may be the color of the moment, according to the decree of fashion, or it may be of her own favorite color—quite the one for her and incorporated by her in various tones throughout her entire wardrobe. With all this settled and definitely in her mind she turns to the selection of her car and considers it with equal care, making clear to the designer her desires so far as color is concerned, and working out with him the details on that preface.

An interesting shade for the dark woman this season is red, and deep, dull tones that accentuate the florid color of the Latin type of woman. The most favored tone of red shown for the motor car is called Sultan red. It is somewhat kindred to the Chinese red so popular a few seasons ago, and while it is dull it is rich and has character and harmonizes with practically any shade of red in one's gown. A very bizarre and artistic effect may be had in combining it with flame color, now much favored for evening gowns. The exteriors of the cars are rendered striking by the combination of a painted body set off by a hood of aluminum or nickel.

Various shades of blue are used for interiors by blond women, who also find greys and tans particularly fitting. But the soft tones of these latter shades are offset by the brightly painted exteriors. The car for the country, which is taken a little more seriously these days by the feminine motorist, who delights more and more in driving her own car, is done in any of the striking colors.



Interior of Brewster landaulet, which is upholstered in a hair line stripe worsted cloth by Boyriven. Note arm rest, upholstered foot rest, smooth upholstered rear quarter and other luxury features.

Air-Cushion Seats

Many new ideas have been introduced this year in the way of comfortable seats. In the more expensive cars air cushions are shown resting on the more substantial ones of horsehair and leather. These are covered with a delicate grade of leather or other material. They are also used as back rests and are detachable, only fastened into place by decorative straps. The foot rests, now considered a necessity, are rendered more decorative than before, and in practically all the high-priced cars extra pillows are

furnished, either of the same material and design as the cushions and footrests or of contrasting material and color. Some of these are of silk and very elaborate. The seat in some of the limousines is fashioned after a comfortable arm chair, with a large arm rest well padded. In a few of the models these arm rests can be raised and fit comfortably into the back of the seat. Some even disappear completely and may be used or not, according to fancy.

In a number of the most expensive cars, this matter of arm rests has been carried very far, the usual three-passenger rear seat being converted into a pair of single seats, with massive central ar mrests and the usual side arm rests. This has been well carried out in the driver's compartment, too, for the extra central arm rest is very pleasing either to the owner-driver or to the chauffeur, in that it keeps the other front seat occupant as far as possible from the actual operating means of the car. Many an accident has happened because of three in the front seat.

One elaborate car seen at the Salon last winter has this central arm rests idea carried out even farther, use being made of the bulk of the arm rest to include in it a modest cellerette, well equipped with small bottles.

In many of the new cars the front of the tonneau is entirely inlaid with handsome woods—mother-of-pearl or enamel. Since in most of the newer models the collapsible seats are folded into the bottom of the car, the front is used for various purposes. In one attractive model there was a large space where parcels could be deposited so that the car should never look cluttered up, and the vanity cases are so large they can fill all the needs of a week-end bag.

Artistic Trimmings

Only in the standard cars are the vanity cases boldly shown. Even when the vanity cases are at the side of the car within easy reach of the occupant they are arranged so that they disappear into the side and are neatly concealed by some clever device. The trimmings of inlay of mahogany with other rare woods in various combinations are becoming popular. These seem to fit in well with a motor car and are less tiresome than some trimmings that have been used in the past.

The materials, too, are varied to a bewildering degree. There are broadcloths, twills, rep and heavy duvetyne. In the smarter cars two or three of the materials will be combined and sometimes different tones, but always in the same color. Never is the contrasting cloth of any combination of colors used for the interior. Plain materials are favored, although some striped twills are shown and work in very nicely in some models. One stunning model has a plush carpet of deep tan, with the upholstery of a lighter shade and the cushions and foot rests of a sand color.

As has been pointed out previously in these columns, this seems to be a great year for bedford cords, and the better class cords are being used very widely. These include both wide and narrow wales, and in a considerable variety of patterns and colors.

Marked attention has been called in these columns as well, to the modern tendency toward smooth upholstering, especially to the use of perfectly plain smooth fabric interiors for enclosed cars on the one hand, and to the use of plain pleated upholstery without diamonds or any of the old buttons on the suabs, and in a number of cases, of plain perfectly smooth upholstery in leather without either pleats or diamonds.

Among the lower priced cars, much greater attention is being paid to the artistry of line. These models are being hung lower and lower, thanks to the greater improvement in American roads which makes this possible, and also to the new sizes of tires which make it possible to carry the same load on a new combination of larger cross section and reduced diameter. This low-hung appearance, which was exclusive with the custom-built cars of a few years ago, is now becoming quite general. This and the greater lengths of the moderate priced cars is giving all of them a very much superior appearance, and that too, with marked improvement in riding qualities.

N. Y. Motor License Records Show Increase

Unprecedented in numbers of new drivers applying for licenses, the New York City Motor Vehicle Bureau finds itself an excellent barometer of the great increase in automobile buying on the part of those who have never driven a car before. A new record of 4,464 applications was established in the last week of May. In one day, 1,044 asked for permission to drive their new purchases. Adding to the value of the figures is the fact that there were no renewals among them.

While statistics are not yet available as to the proportion of chauffeurs and owners among these applications, it is estimated that about 40 percent were in the former class. An interesting side light is that to date this year about 155,000 owners have been given a license to drive while 175,000 chauffeurs carry the police department's card.

U. S. Conducts Unusual Road Tests

More than 30 types of road building materials will be tested at the Arlington experimental station of the Bureau of Public Roads at Washington, D. C., in a series of experiments just begun. The composite road is constructed on a circular plan. Five-ton army trucks will subject it to trial without ceasing for five or six months and in such a manner as to practically cover every square inch of the 15-foot width.

Another roadway of 65 sections of variously mixed concrete will also be tested. A specially constructed truck, equipped with different kinds of tires, skid-chains, and guided in the same path by a small set of rails, will run over the road at an average speed of 20 miles an hour, with and without loads. Particular attention will be given to the road's wearing qualities and the effects of weather.

Fiat Plant Sold

The factory in Poughkeepsie, N. Y., of the Electric Auto-Lite Corp., which was formerly the Fiat assembling plant, was bid in at receivers sale June 14 by C. O. Miniger of Toledo for $300,000. Miniger, who already has bid in the Auto-Lite plants at Toledo and Fostoria, said he expected to open the Poughkeepsie plant in the near future.

Business Failures Fewer in May

Business failures in May totalled 1,960 or 28 percent below the high point of the current year. Comparison with April shows an index decline of 9.5 percent. May indebtedness was $44,402,886 or 39 percent under April.

Ramage Gasoline Process Successful

BY J. B. WALDO*

New Process for Production of Motor Fuel from Crude Oil Is Said to Turn 70 to 85 Percent of Oil to Motor Fuel—Some Details of This Revolutionary Process

IF ALL that is claimed for the Ramage process of producing motor fuel from crude oil is true and can be proven, this process will, as is claimed for it, knock all cracking processes, and all other refining processes into a cocked hat. Here are some of the things claimed for it: It is simpler, cheaper, easier and cheaper to operate, easily installed, gives 70 to 85 percent yield of motor fuel, and the fuel yielded is of unusually high quality, comparable perhaps with aviation gasoline.

In connection with these claims, it is said that the recent advances in the stock of the Barnsdall Corporation were largely due to a desire of certain very large oil organizations to obtain some interest in, if not control of, the Ramage process, which is owned by the Barnsdall Corporation. It is further stated by brokers that the large petroleum companies which were buying Barnsdal stock were paying as high as $125 a share with the idea of securing control of this process of which it has been claimed that it is much easier to operate than any process now in use as it requires no pressure or skilled operators, can be installed in any refinery between the still and the condensers, is very cheap to operate and produces a larger percentage of gasoline of a higher grade than any other process. The gasoline also has the advantage of not depositing any carbon on the cylinders.

A statement made recently by E. B. Reeser, who is president of the Barnsdall Oil Co., and vice president of the Barnsdall Corporation, is enlightening regarding both the history of the process and the results obtained in a series of tests on a commercial scale.

President Reeser stated in regard to the history of the process and the company's connection with it, that in the latter part of 1920, a few men interested in the automobile business in and about Detroit, came to the Barnsdall corporation and stated they had developed a new product from petroleum to supplant gasoline. For a considerable period of time Dr. A. S. Ramage had been working upon a process to manufacture this product, and these automobile men had financed the construction of a small laboratory in Detroit. From the laboratory standpoint the process was a complete success.

"The syndicate which had so financed Dr. Ramage's investigations, desired a conservative, independent, oil company to further work out the process commercially, and selected the Barnsdall corporation.

"Robert Law, jr., president of Barnsdall, authorized the head of the refining department to make an inspection of the plant in Detroit. After a careful investigation the company entered into a contract with the Detroit syndicate for exclusive rights in the United States and Mexico and agreed to proceed with the development on the basis of commercial use and sale of the product.

"At the refinery of the Barnsdall corporation, following the installation of the initial plant, larger units were installed and today the company has in actual operation a 500-barrel-a-day plant, and under course of construction 500 barrels a day additional capacity.

The Ramage Process

"The process itself is known as the 'Ramage Process,' and consists of passing over iron ore in a close tube vaporized oil mixed with steam. A yield of motor spirit, with the use of gas oil, has devoloped from 70 percent to 85 percent gasoline. The remaining percentage is now under a course of treatment, and Barnsdall coropration expects to develop useful products from the residue.

"The cost of operation is nominal as the gas taken off is used for fuel to operate the furnace, and the iron ore, while originally of little cost, in no way deteriorates.

"The resultant product is of the gasoline family, and is practically free from carbon-forming compounds, can be used with any carburetor now in existence, and from actual tests in operation of ordinary automobiles, shows conclusively an increase in mileage of 25 percent and a similar increase in power. The most remarkable development in its actual use is that the labor in a motor, which is generally referred to as a 'knock,' is almost entirely eliminated.

"The process has been patented in the United States, and applications are being made for patents elsewhere. In addition the product, which the Barnsdall corporation has named 'super-gas,' has also been patented.

"The raw material necessary for the use of the process must supply a heavy oil vapor. Thus the process is usable with crude oil, fuel oil or gas oil as a basis, and, unquestionably, there will always be an available supply of one or other for the purpose of the treatment of the process.

Cost of Operation

'The cost of the product is small. Taking fuel oil as a basis, the fuel oil would be heated until it vaporizes, and the vapor is passed through the tube with which steam is mixed, and this combination of steam and vaporized oil, in contact with the iron ore with which the tubes are filled, at proper temperatures, causes a chemical reconstruction, so that the resultant product coming out of the tubes contains a large percentage of super-gas, which is subsequently separated, and the heavy product left is again put through the same treatment.

"While it is claimed that the percentage of recovery of super-gas with the use of this process, from fuel oil, is from 65 percent to 85 percent, to be conservative in arriving at cost, the company takes 60 percent as a basis of recovery. With a basic cost of one gallon of fuel on at 3 cents per gallon, a recovery of 60 percent in super-gas would make a raw material cost 5 cents per gallon, to which should be added cost of conversion, finishing, and royalties, estimated liberally, at not exceeding 2½ cents per gallon, making the total cost of a gallon of the super-gas 7½ cents per gallon.

"While super-gas will undoubtedly command a much higher price than gasoline, on the basis of the present price of gasoline at the refinery of 14¼ cents, this would

(Continued on Page Twenty-Eight)

* Reprinted by arrangement, from Oil News, Chicago.

Interesting British Truck Bodies

Two Novel Bodies Embodying Useful and Economical Principles of Construction.

WHILE the truck industry is more or less in a state of flux, as it is now, it should be realized by truck chassis manufacturers, sales agents, body manufacturers, and all others concerned that much of the success (or failure) of the finished product is going to depend upon the suitability of the outfit to the work. And in this respect, "outfit" means more body than chassis. This being the case, both chassis and body makers should be constantly on the lookout for new and novel ideas in body construction, especially those which are essentially practical and as a consequence may be freely adopted or adapted as the case may be, for new deals which may come up.

With this thought in mind, there are presented on this and the facing page a pair of British truck body designs, which have met with much favor. They have been constructed for a special purpose in each case, and when put into the special service they have not been found wanting, in fact have been highly successful. For this reason a close study of them is suggested.

As will be noted they consist of a market gardener's truck, in connection with which study is invited of another (but an American) design presented a short time ago, and an enclosed van, or as the English term it, a boarded tilt van.

With reference to the former, this body, as shown in Fig. 1, is fitted with removable side ladders and the cab is provided with full doors on either side, with a drop light on the near side and sliding lights on the offside. The body is made up with plank sides held in position by four 2 in. angle irons turned at foot and bolted to the bearers. The main sides are 4 in. by 2 in., and the front and hind earbreadths each 3½ in. by 2 in., respectively. There are five 5 in. by 2 in. oak bearers which rest upon two 4 in. by 2 in. chassis liners. Most builders will prefer to rest the floor on the main sides and summers, but in some cases the summers are dispensed with and the main sides rabetted out to receive the floor so that it may rest directly on the bearers, in which case an extra cross bearer should be inserted. A 2 in. by 1½ in. rail is fastened to the top of the body side, which forms a bearing for the ladders made up of 1½ in. square stuff. The ladders are held in position by means of inside irons fastened at the back and passing through sockets fastened to the plank sides.

The main portion of the body is 10 ft. 6 in. long overall, and 6 ft. 6 in. wide. The body sides are 2 ft. 7½ in. deep, and the height from the bottom side to the top rail of the ladders 6 ft. 9 in. The ladders are kept in position at the top by three cross rails of round iron with hook at one end. The cab is 5 ft. wide, 5 ft. 2 in. high overall, and is swept in 3 in. each side towards the dashboard. The body space of the chassis is 13 ft. 10 in. by 3 ft., and the hind wheel is 10 ft. from the dashboard. In place of the front ladders this part of the body may be boarded up, while other bodies of this type have a hind ladder which is hinged from the top. Outside fixings are frequently employed so as to give a flush surface inside.

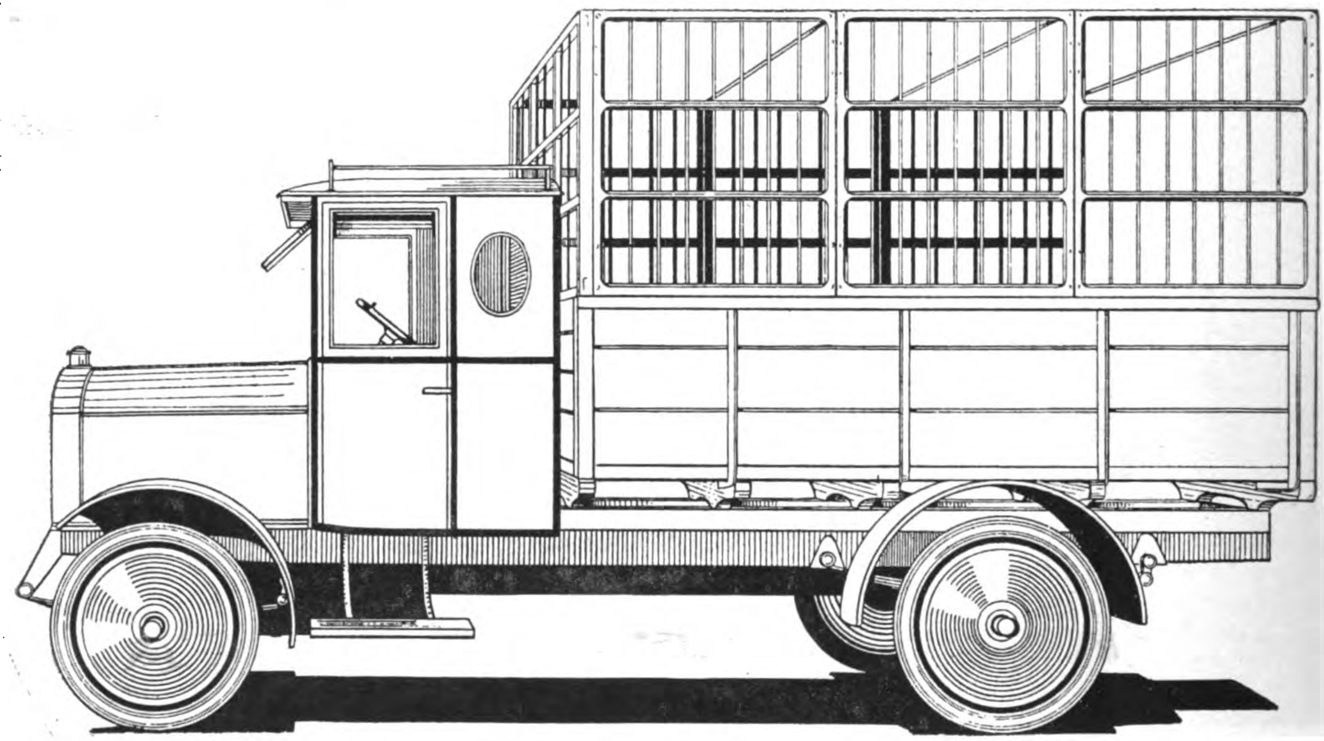


Fig. 1. Side view of Marker gardener's special truck body.

The other truck body, which is described as a boarded tilt van, and is shown in Fig. 2, this being a full side view, has a close boarded tilt, the lower part being finished with outside framing. A tailboard and pair of hind curtains are provided. The cab follows conventional lines, except that wooden front pillars are used in place of wind screen stanchions. This pillar is placed immediately behind the

metal dash provided with the chassis, and is screwed to a fillet or make-up piece fitted inside the dash and screwed to it from the outside. The cross-rail, which is framed in and forms the bottom stile of the screen, is fixed in a similar way. If desired the cab can be finished with outside framing to match the main portion of the body. The mounting consists of two oak chassis runners 3½ in. by 2 in., on which are laid three cross bearers 5½ in. by 2 in., front and hind earbreadths 8½ in. by 2 in. The runners will be bolted to the chassis in the ordinary way, but it is preferable to fix the bearers by means of short pieces of angle iron fastened in the corners formed by the runners and bearers.

The length of the main portion of the body, out to out, is 9 ft. 6 in.; width, out to out, 6 ft.; depth over sides and raves, 2 ft. 7½ in.; height of tilt from floor of van, 5 ft. 11 in. The main sides are 4 in. by 2 in. The front and hind pillars are 3 in. wide at the top and 4 in. at the bottom by 1¾ in. thick, with four standards each side 2¼ in. by 1¼ in.; middle rave, 1½ in. by 1¾ in.; top rave. 1½ in. by 3 in. Panels of ⅝ in. birch. There are seven tilt hoops, 2½ in. by 1 in., boarded over on the outside with ⅝ in. matching, and up the inside above the side raves for a distance of 2 ft. The tilt hoops are let in from the outside and fixed with two screws. The boards at the corners may be cut narrow, or wider pieces bent by wetting and holding over a fire or placed over a steam pipe. When the boarding is completed it should be well planed on the outside, since any irregularities will be emphasized when the roof cloth is stretched and fixed. The tailboard will be framed to match the sides of the body and arranged to shut up inside the body. The cab measures 3 ft. 9 in. from the dash overall, the door is 19 in. wide, the side panel being also the same width. The cab is 5 ft. 1 in. high, with a 2½ in. rise to the roof. The width of the cab is 4 ft. 6 in., which is supported on a pair of 4 in. by 2 in. bearers laid on the chassis, on which the bottom sides are placed and secured with angle irons in the same way as the main bearers. The design of canopy and the arrangement of the moldings allow the side panels to be carried straight through from top to bottom.

A close study of the two designs will show that they follow standard, sturdy construction throughout. The illustrations and part of the descriptive text are reproduced from The Automobile & Carriage Builders' Journal, London.

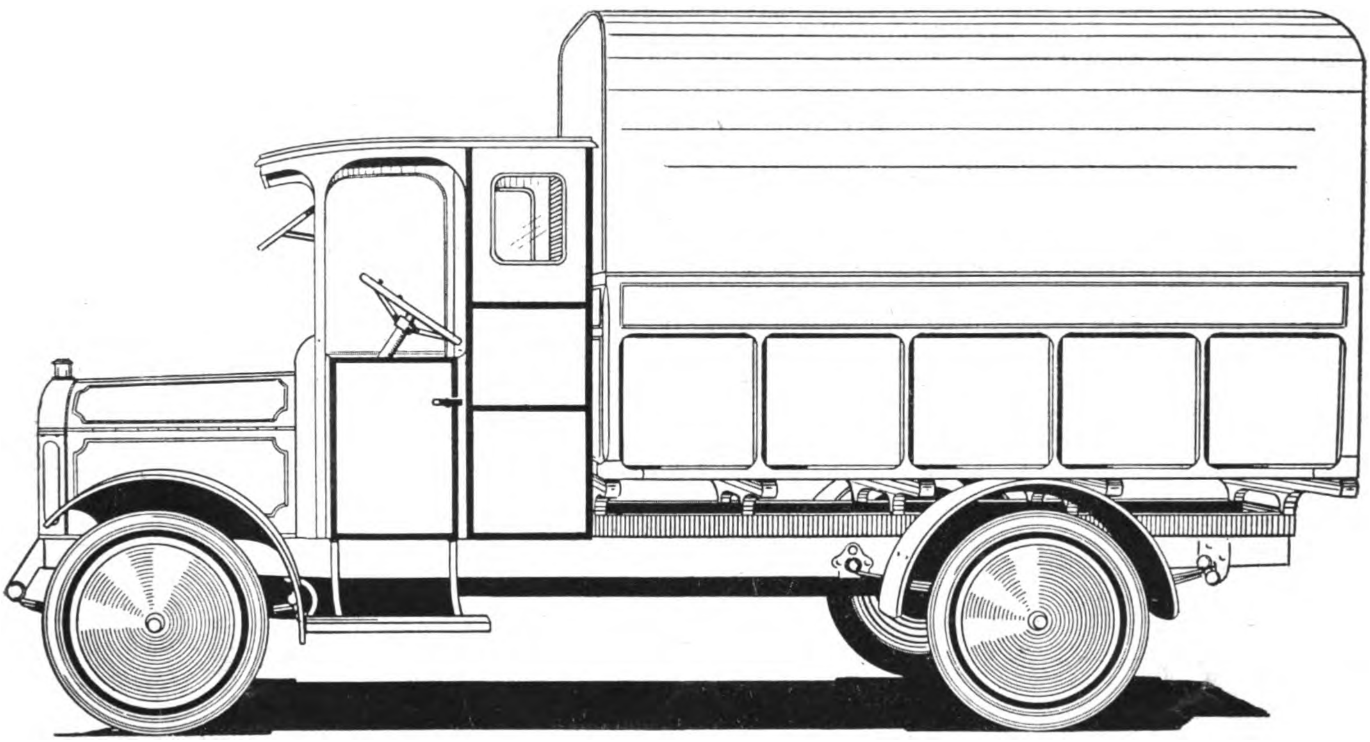


Fig. 2. Special boarded tilt van, a successful British form.

C. B. N. A.'s Golden Anniversary

The fiftieth annual convention of the Carriage Builders' National Association will be held at the Hotel McAlpin, Broadway and Thirty-fourth street, New York, during the week of October 9, 1922. The meetings will be held on the twenty-fourth floor of the hotel. The first convention of the C. B. N. A., was held in New York City a half century ago, and only a few are left of the original membership. During these years the association has convened in many cities, and has listened to many eminent speakers. Now for its golden anniversary, the old organization comes back to its birthplace, where it is hoped all of the members will arrange to gather next October.

Maxwell Had Plans for Chrysler Six

If the Maxwell Motor Corp. had been successful in its bid for the Elizabeth plant of the Willys Corp., for which it offered $5,500,000, it would have used the factory for the production of the Chrysler six, the purpose for which it was built.

Failing to get the property for what it considered a fair price, the corporation is not likely to take up any new building projects for several months at least, although it is probable it ultimately will establish a plant on the eastern seaboard. Nothing will be done in this direction, however, until the return from Europe of Walter P. Chrysler, chairman of the board, the middle of September.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

Paul Morse Richards, *President* G. A. Tanner, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIV JUNE, 1922 No. 3

Financing the Highways

FROM time to time the puzzling proposition of financing new highways comes up. Accepted practice in the past has been along the direction of short-term bonds which would be shorter than the life of the highway. That is, the financing has been based on the theory that the issues should be amortized in the life of the road. Now comes a new theory which leads to the conclusion that 50-year bonds should be offered. This is based on the idea that in modern road building the foundation of the road is permanent and will not have to be renewed, but that the surface which wears out and must be renewed is in substance the less-expensive part of the road. Under this theory maintenance must be changed so as to mean not simply surface upkeep as in the past but rebuilding when necessary, in addition.

On this basis, good roads are permanent improvements (and it is considered that they will never wear out), but as a practical matter, 50-year bonds instead of permanent or perpetual ones are advocated. The advantages of this new plan are obvious. It would enable the raising of funds more readily and without overloading the present generation of road users with the amortization of the road funds. From this standpoint, too, it would enable the raising of more money more easily, so that road construction could be very much greater. This, in turn, would bring about easier, quicker and cheaper road communications so that the plan might readily lead to lowered average living costs.

Another interesting phase of the new proposition on financing road construction is the matter of dividing the cost between road users and the general taxpayers. Relative to this the author of the new plan quotes the recent report of the N. Y. State Special Joint Committee on Taxation and Retrenchment, and we cannot do better than repeat the pungent thoughts expressed therein:

"Some of the enthusiasts for heavy motor fees seem to forget that roads were considered necessary before the advent of the automobile and the truck and that the public's interest in these was often considered sufficient to justify their construction and maintenance as a general public charge.

"On the other hand, some of the representatives of the motor vehicle interests go to the other extreme, asserting that the public builds roads for itself, free for all to use as they choose, and that it is unfair to charge any part of the cost to any particular group of users.

"It seems to the committee that the true view is one which lies between these extremes. That there is a general public intrest in the highways is true, but it is equally true that when these highways cost more than they otherwise would because of the necessity of supplying accommodations to a particular group of users, such adidtional cost may be properly chargeable to those particular groups."

Modern Motor Car Economy

IT WOULD seem that some of the much-talked economy of motor car operation of a year and two years ago is beginning to appear in the cars of today when in the owner's hands. As bearing directly upon this subject, one might cite the recent 360-mile economy test in the Yosemite, and the French economy contest at Le Mans.

In the former, seven small cars of four and five passengers capacity covered the whole distance of 360 miles at an average rate of better than 25 miles to the gallon, five of these did better than 27, and the two leaders achieved an average of 30 miles per gallon. The first, second, fourth, fifth, sixth, seventh, and others farther down the list were four-cylinder cars. On a ton-mile basis, the two leaders varied widely, one being first but the other dropping to eleventh because of its light weight. Other shifts made the six-cylinder cars show up better by comparison than did the fours, reversing the situation on the miles-per-gallon basis. The only eight-cylinder car in the contest was tenth on a mileage basis, but being the third heaviest moved up to fifth on the ton-mile basis.

In the Le Mans contest, all the cars were of the four-cylinder type, so the two contests can not be compared. In addition, the fuel was benzol, so that again, comparisons are impossible. However, the results are of great interest. The winning Citroen, a four-cylinder engine of 2.67 in. bore and 3.93 in. stroke, roughly 2⅝ by 4, carrying four passengers and weighing 2,486 pounds total, covered 100.4 miles on 1.49 gallons, or an average of 67.38 miles per gallon. That this was no fluke was shown by the fact that a similar machine, similarly loaded but weighing 2 pounds more, did 99.9 miles on the fuel allowance, or 67.04 miles per gallon. A third machine averaged 60.06 m. p. g. A Mathis of the same cylinder capacity averaged 65.09 m. p. g. despite the loss of some fuel at the start. Others of this make were seventh, tenth and eleventh, with 99.11, 43.74 and 73.97; however, those, which attained the greater distances carried but two passengers, and in the general rating were correspondingly penalized. The eleven cars finishing averaged 57 (scant) miles per gallon, and if we except one big car, the Voisin, with Knight-type motor of 274 cu. in. cylinder capacity, the other 10 averaged 60.6 m. p. g.

With three exceptions, the motors are smaller than are made in this country but the grand average shows what can be done if designers set out to produce cars which

(Continued on Page Twenty-Eight)

American Motor Car Opportunities All Over the World

Present Conditions Render Exporting Highly Important to Automotive Manufacturers, and World Conditions Offer Many Opportunities—Europe, Asia, Africa, South America, Australia, Elsewhere.

PRODUCTION in the United States has reached such high levels—and the record breaking for May, and apparent indications of another record breaker for June, emphasize this—that the automotive manufacturers must look outside of this country for a large and growing percentage of their sales. Each year this is destined to increase, as the home consumption either slows down or reaches a fixed maximum. And as this foreign outlet becomes larger and larger it will become more and more important.

Right now is the time to lay down good, stable, permanent outlets for American cars, and right now conditions are ripe for fair sales in a number of countries. In what follows a number of different countries will be mentioned and conditions in each described from the standpoint of automotive sales. To begin with, however, it should be noted that March sales of all cars and trucks going out of the country exceeded February by 38 percent, while February in turn exceeded January by 23 percent. The figures for later months are not available, but it seems a fair assumption that each of these months exceeded the month preceding by more than 25 percent. June and July should see an approach to some of the pre-war records of export shipments.

The distribution is changing, however. Canada is still the leader with Australia high upon the list. The United Kingdom, which has always taken a considerable number, is well up among the leaders, but its own exports have fallen off remarkably. In the first quarter of 1922, the figures were 20 percent under 1920, and 50 percent under 1921. This happened while our own trade was showing almost universal increases.

Increase Well Distributed

Our leading markets for passenger cars were practically the same as in the two previous months, Canada taking 867 cars valued at $928,359, Australia 786 cars valued at $620,729, and Mexico 596 cars valued at $434,505. Belgium, however, fell off from fourth place to the 15th, importing only 58 cars valued at $65,835, while the United Kingdom took 247 cars valued at $192,842, an increase of 215 cars over the number imported in February. Argentina, British South Africa, Cuba and Japan were the next important markets, in the order named, all having imported over 150 cars.

Japan was the leading market for motor trucks, having $620,729, and Mexico 596 cars valued at $434,505. Belgium, 110 trucks valued at $162,904. Although Mexico took the greatest number of trucks in February, it fell back to fourth place in March with only 35 trucks imported valued at $37,446.

American Cars in Favor in Poland

American motor vehicles, especially the heavier types, are very popular in Poland, says Trade Commissioner Smith, Warsaw, in a report to the Department of Commerce, largely due to the fact of the surplus war stocks sent into the country. At the present time, the sales of motor vehicles are hampered by the low value of the Polish mark and the high price of gasoline, which sells for from 35 to 40 cents (U. S. currency) per gallon. The Poles have consequently turned their favor to the lighter cars with a lower gasoline consumption. With the exception of motor equipment for agricultural purposes, the motor vehicles of Poland are largely concentrated in the cities and industrial centers. It has been estimated from reliable sources that there are about 2,500 passenger cars in the country, of which 200 are in the military service. Motor trucks number about 2,700 with 1,200 in the military and public service, and about 400 motorcycles, a large percentage of which are equipped with sidecars.

Market for Accessories in British Columbia

Motor accessories of recent issue will readily find a market in British Columbia, according to consular reports from that province. American firms are gradually establishing factories in Canada and consequently the imports are diminishing from the 50 percent of automotive products sold in Canada during the last few years. Until recent years most of the automotive products purchased in Canada were imported from the United States, but owing principally to the rate of exchange and the high tariff on this class of goods, American firms have gradually been establishing factories within the dominion. Imports along these lines have consequently diminished steadily until now they are less than 50 percent of the supply. There are about 50,000 motor vehicles in British Columbia which has a population of 700,000.

Havana, City of Taxicabs

The total number of motor vehicles in Cuba at the present time number 19,689 passenger cars and trucks, according to an estimate made by Acting Commercial Attache Jones, from figures given out by the various dealers. Havana is a "city of taxicabs" as is shown by the fact that there are 5,686 taxicabs and 3,775 private cars. In addition there are about 2,923 motor trucks and 30 trailers in the city. Only a small number of the cars in Cuba are located outside of the cities owing to the poor roads in the country. Traffic conditions are congested a good deal of the time due to the narrow streets in the cities and large number of taxicabs.

Automobile Trade in Spain Picking Up

Several representatives of American firms in Spain report that sales will be on the increase in 1922. One representative believes he can sell 150 during the year while another already has orders for 40 cars.

According to Commercial Attache Cunningham, the past depression has been due to the fluctuating exchange, lack of foreknowledge as to the tariff and finally the failure of banks and lack of prosperity. The permanent tariff of Spain went into effect on February 17 and is somewhat lower than the temporary one on the average.

It is only comparatively recent that motor cars have been used in the Vige district, says Consul Wilson, and only about 1,000 motor vehicles of all kinds are registered there. Consul Wolcott estimates that there are at present in use in the Bilbao district approximately 3,000 pas-

senger cars, 400 trucks and 500 motorcycles of which about 30 percent are of American origin.

Motor Vehicles in Small Demand in Bulgaria

Bulgaria is not well developed industrially, says Consul Kemper, Sofia, and the agricultural enterprises are divided into small holdings. The need for motor propelled vehicles is therefore very limited and prospects for extensive sales in the near future are not very encouraging. A few trucks are being used during the summer as omnibuses and the army uses about 50 of more than three-ton capacity.

Eight Hundred Cars in Persia

It is estimated from local data, by the Consul at Teheran that there are 812 motor vehicles in all Persia, 283 of which are in the city of Teheran. Most of the remainder are in the various larger cities of the country. This number is a large increase from the last registration taken in March, 1920, when there were but 40 passenger cars and 4 trucks in all Persia. The British, in their withdrawal from Persia during 1921, disposed of a large number of Fords and perhaps a half dozen trucks at auction. These cars were nearly all in a bad state of disrepair and it is doubtful if they will be in service for more than a year.

International Automobile Show at Barcelona

The second International Automobile Show of Spain will be held at the Park of Montjuich in Barcelona from May 24 to June 5, 1922, under the auspices of the Camara Sindical de Automovil and the Camara Sindical del Ciclismo. The first of the expesotions in 1919 was a great success and all available space for the coming show has already been taken. Representatives of American automobiles and accessories have made arrangements for a good share of the space, according to a report from Vice Consul O'Hara.

Motor Trucking in Rumania Not Feasible

Motor trucking would undoubtedly be resorted to in Rumania, owing to the deplorable condition of the railroads there, were it not for the poor state of the roads and streets in the country. The use of trailers is particularly unfeasible as the city streets are generally paved with stones and the country highways and roads are in a state of disrepair and full of holes. The few trucks in use for transport between Bucharest and the river ports of Braila and Galatz need all their tractive power in moving their own loads, says Consul Palmer, Bucharest.

American Cars Lead in Imports Into Brazil

The two Brazilian ports, Rio de Janerio and Santos, imported 53 American cars and 17 cars of other countries during the period March 19 to April 17, according to a cable from Commercial Attache L. Schurz.

International Automobile Races in Czechoslovakia

The Sixth International Automobile Races to be held in Czechoslovakia were scheduled to be held on April 16, on the race course Zbraslav-Jiloviste, near Prague. These races were promoted by the Czechoslovak Automobile Club of Prague and were held for the first time in 1908 and annually thereafter until the outbreak of the war. The first one after the war was held in 1921 and was so successful that the club has decided to make them an annual event, says Consul Winans, Prague.

Good Market for Motor Trucks in Brazil

Prospects are generally good for the sale of motor trucks in Brazil, especially in the 1½-ton size, according to recent consular reports received by the automotive division of the Department of Commerce. Contingent factors, however, are the betterment of exchange and the improvement of roads.

While business is improving slowly the demand for motor trucks in Sao Paulo, of which there are about 800 in the district, will continue to increase as there is a decided campaign on for the improvement and building of roads. The city of Sao Paulo is more or less the industrial center of Brazil and motor trucks are much used there.

While at present and for some time to come Bahia offers a poor market for motor trucks, there should be a fair demand for heavy service trucks when the exchange becomes normal, although the high price of gasoline and cheapness of labor are serious drawbacks. Great quantities of heavy goods, such as hides, skins, cocoa, sugar and tobacco are constantly being moved from the warehouses to the docks. At the present time this merchandise is transported by small two wheel carts capable of carrying about one-half ton each and on account of the large number required to handle the business, the traffic is often blocked. There are not more than one dozen trucks now being used in Bahia.

The market for motor trucks in the Rio de Janeiro district is limited to the city of Rio de Janeiro, the main hindrance to the greater use being the lack of roads outside of the city. The interior traffic is practically limited to oxcarts, the roads being unfit for automobile vehicles. Trucks sold in the city of Rio de Janeiro are mostly one and a half-ton capacity. The seven-ton type may be classed second, with the two, five and three-ton models next in the order named. The number of trucks in the district is estimated at about 500.

At present depressed financial conditions prevail in the Porto Alegre district and the importation of motor vehicles has been reduced materially. Even in normal times, owing to the lack of good roads, the demand for motor trucks in this district is limited, and their use is almost exclusively confined to the larger cities. The majority of trucks are of the 1½-ton size, equipped with bodies constructed locally.

Argentina Imports Reflect Improvement

The demand for moderate and low-priced motor cars in Argentina is improving, says a cable to the department of Commerce from Commercial Attache Feely at Buenos Ayres. March imports from the United States of passenger cars, not including Ford, totaled 301, chassis 3, and motor trucks 3, as against 42 passenger cars, 28 chassis and 8 motor trucks from Europe. Two hundred and sixteen cases of accessories reached the country. Sixty-four cars of American and 22 of European makes were imported during the corresponding month last year.

United Kingdom—Motor Truck Market Glutted

The market for motor trucks in the United Kingdom is decidedly unfavorable, the most important factor contributing to this condition in England being the oversupply on account of the surplus army stocks at Slough in Berkshire and the policy of the government in realizing on these supplies on the deferred payment basis. Agents of motor truck manufacturers state that at the present time they are utterly unable to move their stocks because of the far more advantageous price and credit terms being offered by the government, which is selling reconditioned trucks with a six month's guarantee, as low as £50, whereas local dealers have had stocks on hand for over a year which they offer at £700 to £800.

The market in Scotland is depressed as a result of the

general stagnation in trade and industry, and until the hoped for revival is apparent the prospects for the sale of motor trucks are not encouraging. In this section of the country, the demand will be chiefly for the heavier types while the light delivery wagons are enjoying increasing popularity.

France—Conditions Unfavorable to American Trucks

The sale of American motor trucks in France is greatly hampered at present not only by the French import duty of 45 percent ad valorem, but also by other adverse circumstances as reported below:

The difficulties in the Lyon district, says Vice Consul Fullerton, are due largely to the depreciation of French exchange, the activity of French truck manufacturers who are able to promise immediate delivery (the Berliet factory has its plant at Lyon), the existence of large army stocks and the alleged inadequacy of repair facilities for American cars resulting from the lack of spare parts and experienced workmen. It is believed, however, that connections made now will be of value in the near future.

Owing to the exceedingly high price of gasoline motor trucks are being used to a very small degree in the Limoges district, according to Consul Delisle, and industrial firms are unwilling to substitute the motor truck for the horse until the cost of fuel is reduced. Consequently large quantities of raw materials and finished goods are now being carted to and from the railway stations to all quarters of the cities by horses, and some large trucks were purchased from the American army stocks, while the number of lighter models is negligible. There will be little opportunity for the sale of motor trucks for several years to come.

The very small demand in the Nancy district is due in a large measure to the liquidation of army stocks, and as long as the general depression lasts no improvement in the motor truck market can be expected. The one and a half and 5-ton trucks with low gasoline consumption are preferred.

Better Prospects in Straits Settlements

During 1921 the market for motor vehicles was exceedingly dull due to the slump in rubber and tin, and there was practically no importation of motor trucks. The current year will undoubtedly witness somewhat better conditions, says Consul McNiece, at Penang.

A great deal of the hauling in the Straits Settlements is done by oxcarts and hand carts, which is a very tedious and slow method, but comparatively cheap. While there are excellent roads throughout the Colony and the Federated Malay States, those on the private estates are not fit for the use of motor trucks. Many hired cars traverse the roads carrying both passengers and produce of all kinds. As most of these cars are in a disreputable condition it would appear that they might be superseded by motor trucks; none of the latter, however, have been introduced during the past year. At present, there are only about 50 motor trucks in Penang.

Asia Minor—Market Depressed

At present the truck business is exceedingly dull due to the unsettled conditions throughout the Near East. An attractive field for the sale of all kinds of automotive products will undoubtedly be offered in Asia Minor, according to Assistant Trade Commissioner Gillespie, at Constantinople, when peace is reestablished and the several trade routes leading out of Constantinople are reopened.

West Africa—Market Promising

British and French West Africa have begun to import trucks to a considerable extent, says Consul Yerby, in Senegal, and while money at present is scarce, importers are quite prepared to do business. Trucks are used in collecting the raw products and transporting them to the railway, river and shipping stations, and for the distribution of imported goods. The seaports have begun to use trucks almost exclusively for hauling instead of the old method of head carriage. The one-half, one, and one and a half-ton trucks are those preferred. In most of the colonies heavy trucks are prohibited by law.

American cars sell cheaper than those of British make in South Africa, according to advices received by the automotive division of the Department of Commerce. South Africa's chief source of automotive products in 1913 was Great Britain, with a total of £460,797 compared to those from the United States, totaling £389,057. In 1920, the United States furnished £2,952,985 worth of motors and spares as compared to the amount of £427,441 from Great Britain. The returns for 1921 are not yet complete, but the same proportion prevailed although the quantities were much smaller. Taking the above figures as a basis, the normal market is estimated as being capable of taking 600 cars per month in the future.

A comparative price table, eliminating Fords and the higher priced cars with the prices of British makes estimated, shows that on the average American cars sell for from £275 to £140 cheaper than the corresponding British makes. The American dealers score heavily on propaganda as well as price, while the Britisher has done little if anything along that line. However, the British manufacturer does enjoy many advantages, namely: (1) a 3 percent preferential tariff in South Africa; (2) a sentimental preference equal to at least 10 percent; (3) an advantage in the balance of exchange amounting to about 10 or 12 percent; (4) and the advantage of lower freight rates due to proximity of the market as compared with the United States.

American automobiles will probably continue to enjoy preference in the Spanish market, says Commercial Attache Cunningham, in a dispatch to the Department of Commerce from Madrid, but the advantage of the Germans, French, and Belgians, which might be secured from their depreciated currencies and the computation of duties in the value of the depreciated currency converted into Spanish pesetas, should be a cause of concern to American manufacturers and exporters in these lines. The method of doing business of these competitors should be another factor of concern. They are sending cars on the consignment basis, and in view of the fact that Spanish dealers cannot be sewed up in iron clad contracts with American houses at the present time, these competitors are at a big advantage.

Western Greece Needs American Automotive Products

The leading industry of western Greece, the cultivation and packing of currants, is one which offers a great future to motor transport, according to a report from Consul Stiles, at Patras. However, the market is not exceptionally favorable at present on account of extra taxes on gasoline, bad roads, low value of the drachma and the restrictions placed on imports by the Consortium of Banks. A few German and Italian cars entered the market when

the exchange was advantageous with those countries, but the American makes are again in favor and British and French cars are unable to compete. Considerable transportation expense and 50 percent in the time of delivery can be saved by shipping direct to Patras from New York instead of to Pireaus as has been the custom in the past. Three steamship lines are giving such service.

Japanese Automobile Literature

The extent to which the Japanese are interested in motor vehicles is reflected in the automobile literature of the country. Examples which have been transmitted to the automotive division by Automotive Trade Commissioner Irvine, besides three instruction manuals used by a Japanese automobile correspondence school, "The Automobile," "The Motorcycle," "The Electric Ignition," help to break down the ignorance in connection with the internal combustion engines. The pupils of this automobile correspondence school often acquiring a knowledge contained in the books furnished, have a course in a garage and then are promoted to the chauffeur's class. Among the publications is also a copy of "Motor," the best of the Japanese automotive trade papers, with an original circulation of 10,000. The consultation of this publication should result in valuable suggestions for American automotive manufacturers.

Aviation Development in Newfoundland

The practical utilization of the airplane during the winter and spring in Newfoundland for carrying passengers and mails, and for making observations as to the ice and weather conditions off the coasts of Newfoundland and Labrador has been recently successfully demonstrated. The winter isolation of Labrador was broken for the first time by Major F. Sidney Cotton with a Martynside airplane in flights from Botwood at the head of the Bay of Exploits, Notre Dame Bay, on the east coast of Newfoundland, to Cartwright on Sandwich Bay, coast of Labrador and return. Major Cotton has apparently penetrated farther north with an airplane than any other airman and has thus done away with the present arduous method of transportation. The journey has taken weeks in the past and dog sleds and komatics with considerable suffering to both man and beast. The trip was made in one and a half days, due to minor trouble on the way and the return was completed in four hours and forty-five minutes. Major Cotton made an average of 120 miles per hour and found the temperature about 10 degrees below zero.

Where Motor Cars Were Once Prohibited

Motor vehicles were strictly prohibited on the Island Prince Edward from 1908 to 1913 after which automobiles were permitted to be driven on the streets of Charlottetown and one other small town on three designated days per week. Practically all these restrictions were removed in 1919 except that motor vehicles are not allowed to operate outside of towns and cities during the month of April when the roads are very soft from spring thaws.

Progress has been remarkable since these restrictions have been removed, says Consul Crosby, in a report to the Department of Commerce, and today there are 1,753 passenger cars registered in the province, which has a population of 88,000 people. There are only 70 trucks registered in the province and most of those are of three-quarter ton capacity or smaller, due to the poor country roads. It has been intimated that efforts will be made to limit the capacity of trucks in the province, but no definite decision has as yet been reached. It is estimated that there are 58 wheel type and 26 caterpillar type tractors in use, but on account of the small size of the farms in the province the owners of the tractors are of the opinion that they are not an economical success. Three motor propelled fire-fighting engines are in use in Charlottetown, it being the only city in the province which uses self-propelled apparatus.

Aerial Transportation Progress on the Continent

Air traffic in Europe, which is to be resumed upon practically all routes in April, is to be more extensive and is to offer greater facilities in 1922 as a result of an agreement among most of the companies engaged in air traffic on the Continent at a meeting of the International Air Traffic Association in The Hague during the last week in February, says Consul General Anderson in a special report to the Commerce Department from Rotterdam. It was agreed that the central office of the association would issue regulations for the government of traffic on the Continent within the limitations indicated and that all members would conform to such authority. Among other details of the new arrangement it was agreed that in the future aircraft would be equipped with motor mufflers; that larger craft would carry a pilot and an assistant pilot; that machines destined for flights longer than four hours should be equipped with lavatories; that the main parts of machines be constructed so as to be interchangeable; and that an effort be made to encourage the use of aircraft for mail transportation by assuring the International Postal Union that services would be maintained all over Europe from April to September.

The meeting agreed upon the following services for the season which starts in April:

(1) London, Amsterdam, Bremen, Hamburg, Copenhagen.
(2) London, Amsterdam, Bremen, Hamburg, Berlin.
(3) London, Brussels, Dortmund, Berlin.
(4) London, Paris, Lyons, Geneva.
(5) London, Paris, Lyons, Marseilles.
(6) Amsterdam, Brussels, Geneva.
(7) Paris, Strasbourg, Prague, Warsaw, Vienna, Budapest, Bucharest, Constantinople.
(8) Konigsberg, Moscow, communicating with the railroad services between Berlin and Konigsberg.

American Cars Popular in Holland

The thirteenth annual exhibition of motor vehicles at Amsterdam under the auspices of "De Dijdiel on Automobiel Industrie," association of the Netherlands, was the largest and most important show of its kind ever held there, says Consul Mahin, in a report to the Automotive Division of the Department of Commerce. It is estimated that about 50,000 visitors attended the show, many of them from other countries.

There were about 150 cars exhibited representing 42 different makes—the United States leading with 16, France following with 12, Germany with 11, Great Britain with 2 and the Netherlands with only 1. The medium and small type cars were the most popular as prices are almost double those in effect in the United States at the present time. Dealers in the lower-priced cars state that sales were far above expectations and it is estimated that 75 percent of the cars sold were of American make. The greatest number of sales was made by the distributor of a low-priced

American car who gave an exhibition of step climbing, the most conspicuous event of the show.

While over 40 percent of the motor cars in the Netherlands are of American make and the percentage is likely to increase as shown by the exposition, it is felt that still greater sales could be made if the price of American cars in the Netherlands could be reduced. This might partly be brought about if American manufacturers would change their policy of requiring agents to pay in full for cars before they are shipped from the United States—an item which adds considerably to the selling price of our goods abroad. Both this item and the heavy freight charges serve to raise the price of American cars far above the prices of competing European makes, which have a negligible freight charge and are sold on credit to the dealers.

Four of the 40 motorcycles exhibited were American makes—which are considered without equal in the Amsterdam district at least. Only a few American accessories were shown.

German Automotive Industry Recovery Rapidly.

Passenger car registration equal to pre-war. Complaint that German cars are not as well made as in 1913. Growing demand for motor trucks.

The growth of the German automotive industry to such an extent as to compare favorably with pre-war production, marks this branch as one of the healthier enterprises in Germany at this time, says Assistant Trade Commissioner Daugherty, Berlin, in a report to the automotive division of the Department of Commerce.

The passenger car registration in Germany on July 1, 1921, was equal to that of 1914, when over 60,000 cars were in use as compared to 52,000 registered on Feb. 1, 1920. Much has been said of the superiority of German passenger cars before the war, but complaint has been heard from post-war foreign buyers that the pre-war efficiency of the high grade German car has not been maintained. Some prominent manufacturers are reported to be building "for export only" a better car than is sold the inland buyer. Germany thus seems to be striving hard to get a footing in foreign markets.

The better known makes of German passenger cars in the probable order of their worth are: Mercedes, Benz, Opel, Wanderer, Adler, Audi, Horch, N. A. G., Protos, A. G. A., N. S. U., Stoewer, Presto, Dixi, Simson, and Elite

Motor Trucks in Demand

The growing demand for the motor truck in Germany is the direct result of its adoption by agriculture and industry. The present registration of 30,424 is over a 300 percent increase over that of 1914. Another factor lending stimulus to the use of the motor truck as a carrier is seen in the rapid increases of freight rates on German railways, which tend to make transportation by truck cheaper than by rail, despite the continuing price increases of motor trucks, accessories, and motor fuel. German firms have been able to transport merchandise from Hamburg to Bremen by motor truck at a 10 percent saving in cost as compared to railway transportation. In addition, 3 to 4 days were saved in the loading, transit, and delivery to ship's side, or to other receiver, besides the cost of transit from freight yard to ship.

The motor truck has been of great service to the "Technische Nothilfe," the well known "Emergency Aid Service," in breaking railway strikes. During the general railway strike in February, 1922, this service ran a schedule between Berlin and Hamburg, carrying mails to Hamburg and food to Berlin.

Business in motor trucks was so heavy last year that manufacturers were behind in their orders, the 1 and 2-ton trucks being the most in demand with the 4 and 5-ton trucks second, while the 3-ton trucks were not popular at all. The inability to deliver promptly, coupled with rising prices, created a demand for used cars. Some concerns tried to renew outworn army trucks, but met with poor success on account of the rising costs of labor.

The most popular trucks are Krupp, Buessing, M. A. N., and material, N. A. G., Daimler, Benz-Gaggenau, Stoewer, Adler, Bergmann, Hanna Lloyd, Horch, Mannesmann-Nulag, Nuernberger Hercules Werke, Vomag, Dixi, Faun, Duerkopf, and Daag.

Three Thousand Automobiles in Yugoslavia

There are about 3,000 motor vehicles in Yugoslavia, including a small number of trucks, says Consul Patton, Belgrade, in a report to the rubber division of the Department of Commerce. Ninety percent of the passenger cars use millimeter clincher tires, 7 percent inch clinchers, and 3 percent straight sides. Cord tires have only made their appearance during the past year and are slowly gaining favor. Only 2 or 3 percent of the cars are now using them. American, French, Italian, German, and Australian tires are offered for sale. Two American makes, and the German Continental dominate the market, though Pirelli sells well in Dalamatio. Continental tires enjoy a good reputation now as they were well known before the war, though two American makes are coming into general use as a direct result of the energetic selling methods of their agents and because of their quality. American tires are considered to be at least as good, if not better, while recently they have become as low in price as their competitors.

European manufacturers are inclined to ship their tires on consignment to their own factory representatives, or general agents, either for the whole country or for a given district. American exporters ship, as a rule, to general agents in Belgrade or Zagreb. Until recently the American shipments were made cash against documents at New York but now a certain amount of credit is offered.

The rough roads of the country make the consumption of tires per car about double that in the United States. A local dealer places the number of tires bought per car annually at from 6 to 8.

Red inner tubes are much preferred to the grey. There is no prejudice against American made tires and tubes, with one possible exception. Only about 10 percent of the motor trucks use pneumatic tires, the remainder being equipped with solids. The impression is growing among truck owners that pneumatic tires enable them to travel faster and results in less gasoline consumption. However, there has been no distinct switch from solid to pneumatic tires, and it is not probable that any will occur until the roads become better.

Both American and English motorcycles are in use. There are some 2,000 bicycles in operation, nearly all using clincher tires. Motor cycle and bicycle tires are imported and distributed in the same manner as automobile tires. There is a steady demand for solid rubber carriage tires.

Expanding Western Automotive Markets

BY JOHN E. HASTY

Eastern Automotive Manufacturers Planning to Go After Far-Western Business May Learn How Many Coast Manufacturers Have Done It—Study of Successful Merchandising Campaigns—Size and Scope of Advertising

This article relates the actual experiences, as told by a far-western man, of a number of far-western manufacturers, seeking wider distribution for their product, and tells how each one finally secured it, either national in scope, semi-national or restricted to the coast and adjacent states. The far-sighted eastern automotive manufacturer will do well to study it thoroughly before embarking in a large, and consequently, expensive campaign for these same markets. It is reproduced by special arrangement with the Editor of Western Advertising, San Francisco.

A SITUATION somewhat different from selling in the territory adjacent to his plant faces the western (and eastern, too) automotive manufacturer who considers selling his product or products nationally. In the main, this difference lies in the wider geographic distribution of possible purchasers, in the greater extremities of purchasing power, in a more pronounced variation of economic and social environment. Realizing this, wholly or partly, he sets out to discover some form of guidance upon which his selling plan may be based.

In this respect, two courses are open to him. He may endeavor to correlate general economic precepts with the problem at hand; or he may, from the study of actual, successful merchandising campaigns, formulate a method of procedure applicable to his own case. Before such a method can take shape, however, there must be brought together, compared and considered, the plans and systems of a number of merchandising campaigns. Such is the purpose of this article. And while it is by no means complete or final, it may at least throw a light on how some of the conspicuously successful western automotive manufacturers have introduced their respective products in the national market.

Eastern competition is considered one of the major obstacles confronting the western automotive manufacturer. The eastern competitor possesses two advantages: he is close to centers of consumption; his product is usually better known, more firmly established. Yet this first advantage is, to a great degree, offset by the splendid market which the western automotive manufacturer also finds close at hand. The ratio of car owners to population in the very heart of the eastern automotive manufacturing field is approximately 1 to 8 as against a ratio of about 1 to 6.5 in the Pacific coast states. Out of the 15 largest cities in the eastern market, only five had greater jobbing strength than San Francisco; and only three states in the Union have a greater number of dealers than California. Moreover, territorial circulation reports of four motor publications, selected at random, give the western states the third largest circulation in three instances, and fourth largest in the remaining instance—probably a greater circulation in comparison to population than any other territory in the United States.

All of this is clearly indicative that the west is a motoring country, is interested in automotive equipment; and therefore, constitutes no small market in itself. The western automotive manufacturer is not forced to overleap a stretch of barren territory in order to find an immediate outlet for his wares. This fact assumes increasing significance when one considers that it permits the western manufacturer to develop his product and perfect his sales plans before invading a field of broader scope. He has the advantage of being able to do his pioneering work at home, where selling costs are not as great as in distant markets and where he can make accurate observations relative to the selling forces required to secure the attention of the trade and of consumers. Through such observations, relatively exact data may be secured upon which a national campaign may be based.

The Ensign Carburetor Co., of Los Angeles, and the Gill Storage Battery Co., of San Bernardino, have successfully followed this plan. The Leach Biltwell Motor Car Co., also of Los Angeles, and the Doble Motors Co., of San Francisco, are proceeding along similar lines. In fact, the latter concern, after having given Detroit a trial, is of the opinion that the west, with its hundreds of miles of good roads, and its all-the-year-'round motoring, is unsurpassed as a region for developing the new automotive product. Climate is another advantage. Retarding of production due to extremes of heat or cold is rare; and, on the whole, working conditions are more favorable than in the east. For example, the 1921 report of the Goodyear Rubber Co. shows 11 percent higher production per labor unit in the Los Angeles factory than in the main plant at Akron.

These, of course, are purely preliminary advantages. They become significant factors in national merchandising only when marshalled together toward aiding in the effective accomplishment of that end. They are not presented as a means of overcoming firmly established eastern competition. Yet the fact that such competition can be overcome has been exceptionally well demonstrated by the Pneumatic Cushion Co., of San Francisco, manufacturers of the Gruss Air Spring. As the market for this device is largely confined to owners of truck and stage fleets, sales efforts were directed toward this group of possible purchasers. Carefully prepared direct mail matter followed by personal selling was the method employed. It soon became apparent, however, that these efforts were not accomplishing all they should accomplish. The reason was obvious. Among competitive devices was one manufactured by a firm of world-wide reputation, a firm whose name had for years been a by-word for this type of article. It is safe to say that no business institution could be more securely entrenched. Because of this, the Pneumatic Cushion Co., a new concern, found it extremely difficult to get the attention of the dealer and of the prospective purchaser.

Finally, it was decided to supplement direct advertising

with full pages in motor publications. The purpose of this advertising was not to create direct sales but to build up prestige—not, however, through the usual "institutional" style of copy, but through sound selling arguments regarding the device. The plan was eminently successful. Today, in spite of the strongest kind of competition, the entire output of the Pneumatic Cushion Co. is absorbed in the territory between the Pacific Coast and the Mississippi river, an eastern factory being necessary to supply the demand throughout the remainder of the United States.

The Lathan Auto Supply Co. of San Francisco, in merchandising the Critz Grease Gun, has employed somewhat similar tactics. So has the Clark-Turner Co. of Los Angeles, manufacturers of the De Luxe Piston. In fact, it is a theory of the Clark-Turner Co. that, in order to withstand competition, the new concern must advertise its product extensively. The almost immediate success of the Hubaco Re-Boring Machine, made by the Hughson-Bacon Co., of Oakland, and of Spring-Eez, a product of the Halstead Specialties Co., San Francisco, both widely advertised, seems to bear out this belief.

Probably the truth of the matter is that the new automotive product entering a field where competition is securely established requires extensive advertising. This is particularly true if the product is to be sold through the usual system of distribution. The present tendency among the jobbing trade is to limit items handled to those for which exists a well defined demand. Consequently, it devolves upon the manufacturer to create the demand or, at least, to convince the jobber that a demand is being created.

In such instances, too much emphasis cannot be placed upon the necessity of proper financing before operations to secure national distribution are commenced. Sufficient funds should be available, not only to provide an adequate advertising campaign through which to create a demand, but to take care of the demand once it has been created. Paradoxical as it may seem, a too successful advertising campaign is often as disastrous to the improperly financed concern as rank failure. Another point which the manufacturer must recognize is that advertising is not a substitute for sales effort Advertising will serve to create prestige and operate to reduce selling costs; but in a market where there is considerable competition, distribution is only secured through personal selling. Unless the manufacturer who advertises extensively is equipped to take immediate advantage of his advertising through personal selling, his advertising appropriation cannot, under ordinary circumstances, be expected to pay dividends.

Personal Selling Imperative

Even when the manufacturer eliminates the jobber and goes directly to the dealer, the importance of personal selling cannot be disregarded. The dealer, satisfied with the line he has always carried, will naturally disregard the new, untried, competitive article unless he is thoroughly convinced that its particular merits will result in less sales resistance and a large volume of sales. And while the manufacturer's advertising may convince him in this respect, conviction does not necessarily result in action; hence in most instances it is the salesman who must actually make the sale. The outstanding feature of the previously mentioned merchandising campaign is not so much the advertising as it is the consistent tying-up of advertising with personal selling.

The system of Charles Kaufmann & Sons, spot light manufacturers, of Santa Ana, is to split their selling program into three divisions:

(1) Advertising in trade publications to present information regarding the product and to create prestige; (2) direct mail advertising to convince the dealer of the sales possibilities of the product; (3) personal selling to close the sale. The effectiveness of this plan may be judged from the fact that, although competition is extremely heavy, in three years the company has grown from a back yard industry to a concern whose plant now occupies several acres.

In instances where there is little or no competion, it is, of course, possible to merchandise nationally through advertising alone. Even then, results are not usually entirely satisfactory, although George Riley & Co., of Los Angeles, has employed this method with no little success in spite of the fact that operations were begun during 1920 when the condition of the automotive market was anything but favorable toward the launching of the new product. The device manufactured by this concern is a Ford valve attachment, known as the Multi-Lift, which retails for $26. It is sold through dealers, and, in a great many instances, direct to Ford owners.

Inquiries Result in Sales

The Multi-Lift campaign commenced with two half-page advertisements in a publication whose circulation is about equally divided between Ford car owners and small dealers. This was followed by one-eighth pages, one a month, in the same publication, and small space in a trade directory, issued quarterly. While the advertising did not produce a great number of direct sales, it procured at a relatively low cost, a volume of inquiries which were eventually converted into sales by means of circulars and sales letters.

Yet the Multi-Lift campaign can scarcely be taken as a typical example of merchandising in a market where competition is not a formidable factor. In the first place, the device itself is somewhat out of the ordinary; and secondly, the fact that it was sold exclusively through Ford and Ford accessory dealers permitted the manufacturer to reach his market with but few publications. This, together with the small amount of space used, reduced selling costs to a point where an adequate profit was possible without a large volume of sales. Probably a better example is found in the history of the M. K. T. Products Co., of Seattle. This concern introduced its "Time Saver" bearing compound in Seattle late in 1918. Without any advertising whatever sufficient local demand was developed to warrant an enlargement of the business; and in 1919, a factory, with a daily capacity of 10,000 three-ounce tins, was erected in Seattle. At the same time, state agencies for the purpose of distributing the product were established throughout Washington, Oregon and California. By the beginning of 1920, sales had totaled 110,000 tins.

National Demand Develops

At this point, the first move was made toward securing national distribution. Although contracts with state agents prevented selling direct to jobbers and dealers, an advertising campaign designed to cultivate the national market was inaugurated in one trade publication, augmented by direct mail advertising. The result was that later in the year, when agency contracts expired, a healthy national demand had been created; and the transition from the state agency system to selling nationally through

(Continued on Page Twenty-Eight)

More About Used Cars and Trading-in

A Suggestion for Curing the Trading-in Evil and the Modern Way of Overdoing It—Data on Used Car Sources of Supply—Suggested Remedies

WITH the touring car season now in full blast, and with sales of new cars rapidly approaching record figures, not so much is heard about the used car problem or menace as it was called a great many times last winter. However, the cold fact is that many dealers who were rather heavily loaded up with used cars last season have not as yet succeeded in getting rid of all of them. As a result, there is still a very large overhanging surplus of such cars, and right now, unfortunately no such strenuous efforts are being made to dispose of them, since the same effort expended on a new car sale brings in a much larger and quicker profit. It is this kind of short-sighted policy which brought about much of the dealer's difficulty and trouble of the last two years.

These old cars are not increasing in value, on the contrary they are decreasing every day. In addition to this incentive to sell them as quickly as possible, they represent a great deal of frozen credit, inasmuch as money is tied up in them which can only be gotten out by selling them and that is not an easy job, in many cases.

One thing is certain, the lesson of the last couple of years is not going to be entirely lost upon the dealer. If he learned anything, he learned to give a very conservative amount for the old car when traded in on a new one. Of course there are many new dealers who have not yet learned that this is the kernel of the used car situation, and these will continue to get stuck. One way in which this is being done is well illustrated in the following actual instance of a trading-in case.

A certain barber wanted a car, but being by nature extremely close, or near, to use the old Yankee expression, would not pay the list price, despite the fact that he was reasonably wealthy, and thus well able to do so.

Furthermore, his natural sense of thrift told him that he knew nothing about running a car, an old one would be better to practice on than a new one. Therefore, this barber (also originally of Seville) after carefully cogitating the matter decided that he could get a little inexpensive insight into the intricacies of the automobile, and at the same time make some money for himself by the "trade-in trick," rumors of the workings of which had come to him from time to time, and acting on the impulse he purchased a second-hand car—one, by the way, that fully merited the title.

This car cost him exactly $337.50. He kept it a couple of months, parked it in the back yard at night, and by tearing down three sections of the fence in front of his house and bending a telephone pole with the machine, managed to put it in far worse condition than it was when be bought it.

Finally, after he had rid the community of sundry objectionable house cats, and had to a degree learned to distinguish between the mileage and the accelerator, so to speak—he decided that the time was right to realize on his investment.

So he started shopping 'round. The reputable dealers without exception made only a fair and wholly equitable offer for the machine, but the barber was not discouraged and finally succeeded in peddling the car for a trade allowance of $700 with a dealer who only recently had started in business. Also, the fence episode still fresh in his mind, he insisted (successfully), that the new car be equipped with a bumper at no expense to himself. The writer happens to know that this dealer was out exactly $134 in the final reckoning. (Incidentally—he's out another way now—out of business.)

The isolated incident never proves the case, but the foregoing truthful account is not of that stamp as it has its counterpart in every place where cars are sold, and the reader will realize from his experience that this is true.

A friend of the writer's worked a similar game a couple of years ago. He had an old Overland, which had been driven by himself and a previous owner upwards of 30,000 miles, and he was clever enough to realize that it was almost all through. In casting around for a new car, he found an unsuspecting buyer who paid him in cash within $50 of what he had paid for the car three years earlier. He had his eye on a Nash "6" but before he got around to buying a new one, which he had in the back of his mind, had a chance to pick up an old one at a very low price, providing he paid cash. He did this, and then went to a new Nash dealer in his home town, and on a new car which had been returned through inability of the buyer to make payments had come back to the dealer unexpectedly after about 1,000 miles of driving, he managed somehow to arrange a deal by which he took the new car at a price some $400 or more below its real value, and got an allowance on his old car almost the same amount above its value. As a result of this method of working upon the vanity of the Nash dealer in the Nash name and reputation, he got a car as good as new in every respect which was worth practically $1,800 or $1,900 for his old worn out Overland, worth perhaps $300 or $350, and about as much more in cash. The adroit part of the deal was the buying of the worn-out Nash and trading this in to the Nash dealer for much more than he paid for it, the total transaction saving him perhaps $1,000 to $1,100.

To go back to the general used car situation, as it effects the ordinary dealer, several pertinent questions arise. One is where does the used car come from, and what may the total supply be taken at? Against this it is important to know what the demand is as compared with the demand for new cars, and the methods which may be used for stimulating the sales of both new cars and used cars. Relative to these points the National Automobile Chambers of Commerce says:

The situation may be analyzed somewhat as follows:

Source of Actual Supply of Used Cars: Used car dealers; new car dealers; garages, service stations, etc.; financing companies; insurance companies; owners offering their cars for sale; thieves; government agencies having confiscated vehicles for sale.

Source of Potential Supply of Used Cars: Owners contemplating "trade-ins" for new cars; owners contemplating the abandonment of car use for financial or other reasons.

The Total Used Car Supply: The foregoing analysis

makes it apparent that with the exception of—Cars which owners have no intention of selling; cars which are unsalable; everyone of the 9,000,000 or more used cars in this country is always likely to get on the market in competition with the sale of new cars.

The Demand for Used Cars: Persons not now owning car who are in the market for cars but who prefer used cars of better to new cars of poorer grades or are financially unable to buy new cars; persons now owning cars who desire to sell them and buy better used cars or trade them in for better used cars; insurance cheats; wrecking establishments.

The Demand for New Cars: The foregoing makes it clear that the market for new cars is the difference between the total demand for motor vehicle transportation and that portion of the demand which can and will be taken care of by used cars; what these elements amount to in actual figures, types of vehicles, etc., of course, is a matter of conjecture.

Stimulating the Sale of New Cars: By widening the demand for motor transportation it is certain that the portion of it which cannot be cared for by used cars must be cared for by the increased production and sale of new cars; by reducing the number of used cars thus limiting the power of used cars to supply the demand for motor transportation.

Reducing the Number of Used Cars: True valuations for "trade-ins"; campaign urging owners to scrap cars when maintenance and operation costs become excessive and outweigh economics and advantages to be derived from purchase of new cars.

Suggested Remedies—A New Name

A variety of remedies have been proposed some of which may be too difficult to put into practice, others might technically violate laws against restrait of trade, and still others would be only preventative of aggravating the situation and not corrective of it as it exists. All are offered for what they are worth and are given without names or locations of those who suggested them.

First and most important—a new name must be given to the second-hand car that will give it a better standing. Whether it be called "remanufactured" in those cases where it is actually remanufactured, as done by one of the Chicago companies; "reconditioned," "renewed" or any other name, is well worthy of consideration.

A. Used-Car Market Reports. Dealers allowing the quoted market prices for used cars taken in trade.

B. Official Appraiser. Independent and impartial appraisal bureaus to be established in larger cities. Dealers accept cars in trade at price set by bureau. Each dealer to sell used cars he takes in trade.

C. Official Appraisers Paid a Fee by Owners or Dealers. Similar to above plan but supported by fees paid by owner or dealer for each appraisal.

D. Manufacturers Quoting Prices of Second-Hand Product. Maker sets new car price. Might also set second-hand value in good condition for given year. Dealer taking car in trade, deducts from this figure his profit, cost of handling and cost of reconditioning to determine allowance.

E. Dealers Publish Prices of Used Cars Sold. Dealers in each locality to conduct information bureau to make public the sale prices of the various makes of used cars sold by dealers during the previous two weeks. This is similar to the Chicago used car market report which is available to dealers everywhere.

F. Used-Car Exchanges Maintained by Dealers. To be used-car department, sales force and appraiser for all dealers. To buy used cars from dealers, recondition and sell them.

G. National Used Car Markets. For the benefit of intending purchasers of used cars, and in order that the greatest possible line of used cars may be available to such intending purchasers, and that owners of used cars may always find a ready market, it has been suggested by some that such markets be provided nationally, so that every community may have them at hand, and so that the owners of used cars, who wish to avail themselves of such exchange, may be able to make the genuine value of such cars immediately available, and to the same ends that such market issue on the deposit of such a car, a negotiable receipt or certificate which may be used by the depositor of the car, either as collateral upon which to borrow money for the purchase of a new car, or to be given in part payment for such new car. These used car markets may be incorporated with a wide distribution of the stock. One big company in Chicago is now actually remanufacturing each car that it takes in, disassembling it, reboring cylinders and bringing car up to standard.

H. Factory Rebuilding. Cars not too distant from factory to be returned for rebuilding. Practice successful in typewriter industry. One truck maker does it. Raises reputation of second-hand product and saves laying off help because of curtailed new production.

I. Advertising Economy of Obsoleting Old Cars. Some are using advertising to show advantage of disposing of old car, because too expensive to maintain, and getting new one.

J. Used-Car Shows. To raise public esteem of second hand cars and show the thrift of a used car purchase.

What Any Dealer Can Do—"Buy Them Right"

Stop making over-allowances. Honestly recondition cars to give good service at prices charged. Display and advertise them as well, and sell them at fixed prices with as good salesmen and as much concern for customer satisfaction as though they were new, guaranteeing them for a period like a new car and taking same responsibility for their performance. Sell used cars on hand at prices corresponding with prevailing new car prices. Handle used-car business in a separate department from new.

The biggest step toward the solution of the problem is that the dealers taking in second-hand cars, will learn to "buy them right".

Make better and fewer cars. Sell parts for reconditioning used cars at low price. Take dealers' used-car stock into account when figuring territory's potentiality. Warn dealers when they have too many used cars. Discontinue "inside billings." Ship only on bonafide orders instead of on monthly contract allotments. Buy in for salvage own cars over certain age.

A leading trade paper says that the used-car problem will not cease to annoy periodically in such times as these until it is handled on an entirely different basis. So long as used cars are merely accepted in trade just so long will they constitute a periodic menace, but when used cars are bought and sold for profit as merchandise in their own right, that is to say, when the mental attitude of the trade toward the used car is changed, then and not till then will things be different.

Expanding Western Automotive Market

(Continued from Page Twenty-Five)

regular trade channels was made without impeding sales.

The basic plan of the "Time Saver" merchandising campaign may almost serve as a model for the automotive manufacturer who must begin operations on a small scale. The M. K. T. Products Co. tried out its product and tested its selling methods in its own home town. If mistakes were made, these became quickly apparent and were readily rectified. The extension of activities to the entire Pacific coast was then made with reasonable sureness. And not until the product had become firmly established here did its manufacturers seek national distribution. Its growth from a home-town article to a nationally sold product was a gradual one. Each step forward was made secure before the next step was taken. There were no hurried moves, no sudden expansion, no forcing of one factor and neglecting of the others. Finances, production, selling and advertising were developed simultaneously; the balance between them was constantly maintained.

Yet it would be a bold assertion to attribute the success of this company, or the success of any of the concerns mentioned, entirely to merchandising methods. The nature of the product in each case is an important element; and each concern has its policies of price, its systems of production and administration, its manner of deal with the human element inside and outside of the organization, which are even more important. Even in merchandising itself there can be no absolute standards. For in the last analysis, human nature is the basic stuff with which merchandising—the creation and gratification of demand—has to work; and it is impossible to lay down anything more than the most elemental principles.

Modern Motor Car Economy

(Continued from Page Eighteen)

will be essentially economical. The average weight of the whole eleven was 2,829 pounds (with passengers), and eliminating the three big cars, 2,137.

The amount of oil used was marvelous for its smallness. To prevent the use of large amounts of lubricant in an effort to obtain fuel economy at the expense of the lubricating oil, the rules provided that the amount of oil consumed had to be less than 7 percent of the fuel allowance in cubic centimeters. The winner, averaging more than 25 m. p. h., used 3 ounces of oil for the 100.4 miles covered. The big Voisin used but 22 ounces for its 62.2 miles distance, covered at an average speed of 47½ m. p. h., and many of the others used so small an amount of lubricant that it was difficult to measure.

In the Yosemite test, the winner used a pint of oil for the 360 miles or at the rate of 2,880 miles per gallon.

Results of this kind show that real economy of operation is available to the car buyer today. This is more than an answer to a temporary demand; it widens the field of buyers, for there are still thousands who are afraid to buy cars because of their belief that operating costs are very high.

Ramage Gasoline Process Successful

(Continued from Page Fifteen)

leave a net profit on each gallon of super-gas of 7 cents, or $2.94 per barrel.

"The Barnsdall Corporation, at the request of the Detroit syndicate, shipped a sample of super-gas to the Detroit Bus Co., which after analysis and test contracted for their entire requirements for 1922, running into 600,000 gallons of the product.

"In actual experience on sales at service stations of Barnsdall Refinery Co., in and near Kansas City, super-gas is demanding a premium of 2½ cents per gallon at this time."

Lelands Out of Lincoln Company

Henry M. Leland and Wilfred C., his son, are out of the Lincoln Motor Co. Management of the company's affairs has been transferred from their shoulders to the personnel of the combined Lincoln and Ford Motor Co. personnel. Formal announcement to this effect was made by Attorney Harold H. Emmons on June 13.

In the four months that the Lelands have conducted the plant under Ford ownership, there has been great difficulty in reaching a production basis that would be at all proportionate to the orders that the company received. At present, production is about 30 daily, having reached that point from an output of about 15 daily at the time of the sale. The company has claimed that it was handicapped through shortage of materials, but it is known that production methods were unsatisfactory to Henry Ford, who spent much of his time at the plant with his engineers seeking increased efficiency in connection with the attempts to increase production.

Some of the work of manufacturing has been transferred to the Ford plants at Highland Park and River Rouge. This has resulted in the close connection of the Lincoln and Ford companies in manufacturing. This was one of the points that the Lelands had always been most desirous of keeping entirely separated. To them it seemed that the linking of the high class car with the inexpensive one would have a bad influence on Lincoln business. With an amalgamation of the two companies, all of the departments will come under the direction of Ford executives.

The Lelands own no stock in the new Lincoln company. It was understood that when the property was taken over by Ford, he paid the Lelands the full amount of their actual investment in the original Lincoln company. It is reported that Ford will pay each of them an additional $250,000 to cancel their contracts.

New Austrian Car Enters Mexican Market

The Osterreischische Waffenfabriksgesellschaft has introduced its six-cylinder, 23-horsepower Steyr car into Mexican markets through an agent at Mexico City. Only the five and seven passenger models have made their appearance to date, but three other models are now in transit from Austria.

The seven-passenger Steyr is offered in Mexico City at $9,838 (Mexican). The agent claims that the touring-car models are guaranteed to climb a 23 percent grade in second speed and that they will successfully compete with any other car of equal weight in the matter of mileage per gallon of gasoline.

Newspaper publicity credits the Steyr as being the last word in luxuriousness and comfort and the chassis as being the most resistant that can be produced. The car made the trip from Mexico City to Cuernavaca, a distance of about 75 miles, in one hour and 40 minutes—a record for the distance on that road.

Prices of German Cars

Prices of German passenger cars and motor trucks have risen in such measure during post-war years that the trade has adopted a catch phrase, "the automobile business is a business in the rate of exchange." Prices are set by the Association of German Automobile Manufacturers in Berlin, the latest price having been adopted in March Factory prices have risen through six changes from June, 1921, to March, 1922, as follows: For a 6-horsepower touring car chassis without tires, from 43,750 marks to 175,000 marks; for a 10-horsepower chassis, from 70,000 marks to 280,000 marks; for a 16-horsepower chassis, from 89,000 marks to 360,000 marks. In addition, the average price for a touring car body (de luxe) is 100,000 marks; and for a full set of six Continental tires, about 50,000 to 60,000 marks.

In an effort to minimize competition, leading manufacturers in convention have fixed the prices of trucks, with the following results: 2-ton trucks, have risen from 102,000 marks in August, 1921, to 370,000 marks in March, 1922; 3-ton trucks, from 112,000 marks to 390,00 marks during the same period; and 4-ton trucks, from 122,000 marks to 410,000 marks.

Germany has been prosecuting a comparatively active export trade. Shipments abroad, numbered 17,534 passenger cars and motor trucks in 1920 and 5,810 in the last eight months of 1921, while imports totaled only 347 in 1920 and 361 in the 1921 period, principally from Austria.

The cause of this surprisingly small importation (and, incidentally, the almost total exclusion of American products) is the high tariff wall built around German production. Furthermore, the existence of a rigid foreign trade control, policed in this instance by the Aussenhandelsstelle fur die Fahrzeug Industrie, Berlin—a body composed in part of manufacturers and constituting a semi-governmental agency with discretionary powers to refuse import permits—makes for exclusion of foreign goods calculated to compete with the home industry.

In view of the limited foreign-exchange buying power of the average German today, in addition to the present system of control, it is decidedly doubtful whether other countries can sell cars in German markets in numbers worth considering.

The growth of the motor-cycle industry reflects an increasing popularity of motorcycle sport in Germany. The industry also enjoys a fair export market, 3,451 having been shipped abroad in 1920 and 1,928 in the last eight months of 1921.

U. S. Seeking Sand Data

Foundries of the country have been asked to aid the government in collecting data on sands for molds and cores in aluminum-alloy practice. A pressing need is found for the information which is being compiled for dissemination. Foundries which have not received the government's questionnaire are requested to apply for it.

Goodyear Gives Employes Raise

Wage increases averaging between 5 and 6 percent have been granted employes of the Goodyear Tire & Rubber Co. The adjustment follows unanimous requests for more wages made by the workers last week through resolutions passed by the assembly of the workers.

Signs Guide Dealers Through Stutz Plant

At a two-day sales and service conference of the Stutz Motor Car Co. of America, at Indianapolis, the first day was devoted to talks by department heads with a trip through the factory as the end of the formal sessions. In the factory visit a rather novel plan was followed. The entire factory was labeled with signs and legends for each department. It was numbered also to key with a brief catalog.

With each exhibit legend in the catalog the name of the foreman in charge appeared, and he formally met each visitor. While every factory introduces department heads, the foremen are often neglected for one reason or another.

Another innovation was a sheet upon which was listed the number of pieces in the Stutz, those purchased finished, the number of assemblies made in the plant, the number of holes drilled, reamed and tapped, the number of various sorts of metals and materials, etc.

This list gave the visitors an impression of the magnitude and multiplicity of operations and materials and parts handled and work done upon them. Also it gave them a quick view of the proportions of the car and assemblies made in the plant, so that they could form a conception of the factory before they reached the first department.

Besides the guides, one to every four visitors, each dealer was supplied with a miniature catalog that described the twenty-two main departments.

One Car to Fifty White People in South Africa

Statistics show that during the five years, 1917-1921, the Union of South Africa (comprising the Transvaal, Orange Free State, Cape Colony, and Natal) imported 24,265 motor cars. Making allowances for cars reexported and those held in bond, it appears that the motor trade in the past five years has sold on the average 4,536 passenger cars, 375 chassis, and 135 trucks—a grand total of 5,046 motor cars per year. Relying on these figures and on the 1920 census, when there were 25,084 cars in the Union, it is estimated that there are now approximately 32,000 motor cars in operation.

On the basis of white population, this makes South Africa the largest car market per capita in the world, outside of the United States, Canada, and New Zealand. One in every 50 white people owns a car in South Africa, as compared to 1 in 96 in Great Britain, 1 in 152 in France, 1 in 230 in Belgium, 1 in 1,050 in the Dutch East Indies, 1 in 68 in Australia, and 1 in 42 in New Zealand.

Recent registrations show there are only nine makes having 100 or more cars running in Johannesburg; highest having 449; all nine makes are of American manufacture.

Canada and Australia Register Largest Increases

The largest gains by countries of destination in imports of cars from the United States were made in Canada and Australia, the former taking 1,501 passenger cars valued at $1,556,454, as compared with 867 valued at $928,359 in the previous month; the latter imported 1,455 valued at $572,904, as compared with 786 valued at $620,729 in March. Mexico and Belgium took nearly the same number as in the previous month, importing 575 and 374 cars, respectively, during April. Sweden showed a large increase, taking 366 cars, as compared with 147 in March.

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

W. E. Whiting is now associated with the Greenfield Tap & Die Corp. and will be located in Detroit. Whiting has been connected with the grinding industry for 14 years. From 1909 to 1916 he was with the Heald Machine Co. of Worcester, Mass., as apprentice, journeyman grinder, demonstrator and finally as superintendent of the grinding department. In 1916 he went to the Norton Co., where he did laboratory and demonstration work for a short time. For the last four years he has handled sales for the Grinding Wheel Division of the Norton company. Whiting will represent the machine tool division of the Greenfield corporation.

A. H. Frost, formerly chief engineer of the Van Blerck Motor Co., for which he designed a 4-cycle engine, and more recently vice president and sales manager of the J. V. B. Engine Co. of Akron, has joined the Cox Brass Manufacturing Co. of Albany, which he will represent in its relation with the engineering departments of motor car manufacturers.

W. C. Kiefer has been promoted to the office of service manager of the engine division of the Buda Co., succeeding R. A. Kiken, who has resigned to join the Motive Parts Co. of America, Inc., Chicago, as sales manager. Kiefer has been with the Buda company for seven years, and for some time has been acting as assistant service manager.

J. B. Jackson, formerly with the E. I. du Pont de Nemours & Co. of Wilmington, Del., and more recently connected with the Buick Motor Co. at Flint, has become identified with the central office of General Motors Corp. as a personal assistant to C. S. Mott, vice president and chief of the advisory staff.

A. Ludlow Clayden is now chief engineer of gas engine research for the Sun Co. of Philadelphia. The company is equipping a laboratory at its research building at Norwood, Pa., and Clayden's first undertaking will be a study of factors which affect engine lubrication, with especial regard to piston friction.

Hugo F. Hoesterman has resigned as factory manager of the Stearns Motor Manufacturing Co., Ludington, Mich., to become vice-president of the Kickhaefer Manufacturing Co. of Milwaukee, manufacturer of dies and stampings used in the automotive industry.

A. M. Dean, connected with the Templar Motors Co. as chief engineer since its inception, has become associated with the Rubay Co., Cleveland, in the same capacity in the production of a chassis for town cars exclusively. No phaeton models are contemplated by the company.

J. E. Garlent has been made works manager of both divisions of the Motor Wheel Corp., Lansing, Mich. Garlent was factory manager for both Hupmobile and King before becoming connected with Motor Wheel and is widely known in the industry.

Fred L. Rockelman, for the last three years general manager of the Indianapolis branch of the Ford Motor Co., has been appointed general manager of the D., T. & I. Railroad Co., and will take charge of the line at once, with headquarters in Detroit.

C. L. Heyniger, formerly an assistant to Alfred Sloan, Jr., vice president of the General Motors Corp., in charge of production, has been promoted and transferred to the sales department of the Chevrolet Motor Co. at Tarrytown.

H. B. Griffin has resigned as vice president of the Doehler Die-Casting Co., Brooklyn, and is now associated with the Light Manufacturing & Foundry Co., in charge of the sales of the company's die casting division.

W. P. Loudon, formerly of Pittsburgh, has been appointed resident engineer of the automotive equipment department of the Springfield, Mass., plant of the Westinghouse Electric & Manufacturing Co.

A. K. Steigerwalt has been appointed manager of the new parts and service division of the Lansing plant of the Durant Motor Co. Steigerwalt had been connected with the Chevrolet organization since 1909.

P. F. Hackethal has been appointed consulting and research engineer for the Fox Motor Car Co. of Philadelphia. For several years he has been connected with the Mercer and Templar organizations.

Harry M. Rugg, for the past year director of educational expansion of the Michigan State Automobile School, Detroit, has been made assistant experimental engineer for Dodge Brothers.

Charles F. Crawford, who for many years has been identified with the Cole Motor Car Co. as chief engineer, has been appointed chief engineer of the Stutz Motor Car Co. of America.

Joseph Lask has taken charge of the plant of the Michigan Pattern & Machine Works, Detroit. For years he was supervisor of tool making for the Mailometer Co.

S. A. McGonigal has been elected president and managing director of the Cleveland Tractor Co. of Canada, Ltd., succeeding J. L. Hibbard, resigned.

L. J. Belnap, president of Rolls-Royce of America, Inc., has been named as aeronautical commissioner for the city of Springfield, Mass.

N. H. Van Sicklen has been appointed general manager of Apperson Brothers Automobile Co. at Kokomo, Ind.

Body Builders

Nash Motors Co., Kenosha, Wis., let the general contract to the Worden-Allen Co., Milwaukee, for a three-story building, 100 x 400 ft., as an addition to the Four-Cylinder Car Division on Clement avenue, Milwaukee. It will be euipped as a body shop and for general sheet metal work. The estimated cost of the improvement is $250,000. It originally was projected a little more than a year ago, but intermitted because of unfavorable conditions, and is revived because the plant is now overcrowded with orders and the need of additional facilities is imperative. B. W. Twyman is general manager of the Milwaukee factory.

Fisher Body Corp., Detroit, has awarded contract to W. E. Wood & Co., 1805 Ford building, for a six-story plant at West End avenue and Fort street, to be connected and used with plant No. 18. It will be 100 x 1000 ft. The cost is estimated in excess of $400,000, including machinery. Albert Kahn, Marquette building, is architect. The company has also acquired the former plant of the Cadillac Motor Car Co., Cass avenue, aggregating about 650,000 sq. ft., for the manufacture of special automobile bodies. Employment will be given to about 2,000 operatives.

Hayes-Ionia Co., Grand Rapids, reports the closing of contracts for $15,000,000 worth of bodies to be completed by June 1, 1923, about $12,000,000 of which represents bodies to be furnished for the Durant Motor Co. The new orders will require the erection of two units to the present plant, work on which will be started at once. The company is turning out 70 bodies a day at present, and it

(Continued on Pago Thirty-Two)

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Industrial Motors Corp., Rochester, N. Y., has been organized under Delaware laws with 1,000,000 shares of stock, no par value, to take over the plants and businesses of the Selden Motor Vehicle Co., Rochester, and the Atlas Truck Corp., York, Pa., both specializing in the manufacture of motor trucks and parts. Other companies, it is said, will be included in the merger, among these being the Martin-Parry Co., York, Pa., manufacturer of automobile bodies. The consolidated company will continue the operation of the individual plants, with enlargements for greater output. George C. Gordon, president of the Selden company, and John J. Watson, jr., president of the Atlas company, will head the new corporation.

Bethlehem Motor Corp., of N. Y., Allentown, Pa., recently organized to take over the plant of the Bethlehem Motors Corp., bankrupt, has made a payment of $475,000 for the works, lately acquired at a receiver's sale, and will immediately begin operations. Improvements will be made and machinery repaired. Production will be devoted to motor trucks and parts, and it is expected to give employment to more than 500. H. B. Hall is president; E. H. Leland, vice president and treasurer, and W. H. Rodgers, assistant treasurer.

Lafayette Motors Corp., Indianapolis, has been organized under Delaware laws with capital of $7,000,000, to take over the Lafayette Motors Co., with plant in the Mars Hill section. A stock issue will be arranged to provide for expansion and working capital. The proposed consolidation with the Pierce Arrow Motor Car Co., Buffalo, N. Y., has been amandoned. The present management will be continued, and officials of the Nash Motors Co., Milwaukee, will be prominent factors in the new company.

W. C. Durant, head of Durant Motors Co., on June 9, bought at public auction at Elizabeth, N. J., the large automobile plant of the Willys Corp. at Elizabeth, N. J., which was nearly ready for production of the Chrysler car when the severe business depression began in the fall of 1920, for $5,525,000. Mr. Durant announced that he purchased the plant to manufacture the new Star automobile. An initial production of about 500 a day is planned.

The International Harvester Co., 606 South Michigan avenue, Chicago, will proceed at once with the erection of the superstructure of its new plant on West Wayne street, Fort Wayne, Ind., for the manufacture of motor trucks, tractors, etc. It will include a one-story power house and is estimated to cost about $500,000, including machinery. Day & Zimmerman, Inc., 611 Chestnut street, Philadelphia, is engineer.

Ford Motor Co. has closed a deal for 10 acres of land on the Mississippi river, on the outskirts of New Orleans, where an assembly plant to build 150 cars daily will be erected. The plant will serve the southern half of Louisiana, Texas, and a part of Mississippi. It is planned later to develop the plant to take care of shipments to Mexico and some South American countries.

Ford Motor Co., Highland Park, Detroit, is taking bids for a one-story assembling plant, 100 x 200 ft., for its automobile and tractor plant at Green Island, N. Y. Contracts have been let to Stone & Webster, 147 Milk street, Boston, for the first unit of the main plant and work will commence at once. The entire plant will cost in excess of $750,000, including machinery.

E. Edelmann & Co., manufacturers of automobile accessories are having plans drawn for a two-story factory to cost $250,000 to be erected on a site recently purchased at the southwest corner of Logan boulevard and Holly avenue, Chicago. Three years ago this company erected a factory on Crawford avenue, which it recently sold to Bassick & Co.

Triumph Tractor & Truck Co., 114 Southwest boulevard, Kansas City, Mo., has acquired the plant of the Dearborn Iron Foundry, Dearborn, Mo., for the manufacture of tractor and truck castings. The plant was built about two years ago, the investment approximating $250,000, with equipment, and has been specializing in iron and brass castings.

Durant Motors, Inc., 1819 Broadway, New York, and of the Durant Motor Corp. of Mich. officials have organized a new subsidiary, the Flint-Durant Corp., capitalized at $200,000, with headquarters at Flint, Mich., to handle certain features of Durant automobile production. W. C. Durant is president, and G. E. Pomeroy, secretary-treasurer.

Maibohm Motor Co. plant at Sandusky, O., has been sold by W. J. Corr, receiver, to E. G. Kirby, who represents the Arrow Motors Co., which was recently incorporated to take over the Maibohm plant. It is stated that those interested in the Arrow company include stockholders and creditors of the Maibohm company.

Studebaker Corp., 1700 Broadway, New York, has acquired the four-story building at Broadway and 70th street, heretofore held by the Winton Co., Cleveland, for an automobile service and repair works, to be operated as a branch of the main service department at Broadway and 54th street.

Cook Drum Motor Co., 519 West Fourth street, Charlotte, N. C., has acquired the equipment and property of the Cotton States Wagon & Auto Co., for the establishment of a plant to manufacture automobile parts and equipment. I. N. Cook is president.

Hupp Motor Car Co., 3501 East Milwaukee street, Detroit, has awarded a contract to the Everett-Winters Co., Book building, for two four-story additions, 52 x 396 ft., and 80 x 397 ft., estimated to cost in excess of $350,000. Charles D. Hastings is president.

Reo Motor Car Co., Lansing, Mich., has purchased the plant of the Swedish Crucible Steel Co., Windsor, Ont., for a branch works for the Canadian trade. Possession will be taken at once and equipment installed for parts manufacture, assembling, etc.

Studebaker Corp., South Bend, Ind., is taking bids for a two-story assembling works, 72 x 156 ft.; one-story sheet metal working plant, 50 x 97 ft., and one-story storage building, with loading shed. Albert Kahn, 1000 Marquette building, is architect.

Allen Motor Co.'s properties at Columbus and Bucyrus, O., will be sold on June 27-29, the Columbus plant being offered on the 27th and 28th and the Bucyrus plant on the 29th. The property will be sold either in groups or as a whole.

Motor Wheel Corp., Lansing, Mich., has acquired property, 375 x 435 ft., at Shreveport, La., for the erection of a new branch plant to manufacture wire and other wheels for automobiles. T. H. Wagner, Shreveport, is local manager.

Miami Tractor Co., Celina, O., has been reorganized with E. J. Bookhart president, J. C. Drill vice president, and O. Rentzsch, secretary. Efforts will be made to provide sufficient capital to place the plant within operations.

Autocar Co., Ardmore, Pa., manufacturer of motor trucks and parts, has issued bonds for $2,500,000, the proceeds to be used in part for extensions, improvements and general expansion. David S. Ludlum is president.

Taylor Instrument Co., Rochester, N. Y., has completed negotiations for the purchase of the property at 110-112 Church street, Toronto. Extension of manufacturing facilities will take place as demand arises.

Motor Wheel Corporation, 701 East Saginaw street, Lansing, Mich., is taking bids for the erection of a one-story addition, 120 x 400 ft. H. F. Harper is president and general manager.

Moon Motor Car Co., St. Louis, manufacturer of automobiles, is disposing of a stock issue of $570,000, the proceeds to be used in part for extensions, operations, etc.

Du Roth Steel Truck Co., Greenville, Pa., will take bids at once for its proposed motor truck manufacturing plant on Osgood street, to cost about $55,000.

Reasonable Auto Gear Parts Co., Philadelphia, has leased another floor in the building now occupied at 2402 North Broad street, for extensions.

Ruggles Motor Truck Co., Bad Axe, Mich., has acquired a site for the erection of a new plant, 50 x 175 ft. Plans will be prepared at once.

Van Wheel Corporation, Oneida, N. Y., manufacturer of automobile wheels, is planning for the installation of new equipment.

Body Builders

(Continued from Page Thirty)

will be necessary to increase this capacity to 150. The present working force will be increased from 950 to 1,500.

Cotton Motor Co., Boston, Mass., manufacturer of trailers and commercial bodies, are producing natural wood combination passenger and baggage bodies. This new product, styled the Cotton-Beverly, is being made for Buick, Chevrolet, Dodge Brothers, Essex and Ford cars at present. The Cotton company claims to have originated this type of utility body some years ago and it is the subject of trademarks and patents.

Lalor Mfg. Co., 1324 McKinley avenue, Chicago Heights, Ill., recently incorporated with $60,000 capital stock, has leased the plant formerly known as the Lalor Wagon Works and will manufacture truck bodies and wood work specialties. It is not in the market for additional equipment at present. The officers are M. H. Lalor, president and treasurer; H. A. St. Clair, vice president and manager; and O. F. Yanson, secretary.

Martin-Parry Corp. earnings for April are reported to be equal to 50 cents a share, being 150 percent better than the same month of 1921. Income of around $250,000 for April may be compared with less than $100,000 in the same month a year ago. Profits in May will exceed those of last month, new orders showing a 100 percent increase, the company believes.

Haynes-Ionia Co., Grand Rapids, Mich., manufacturer of automobile bodies, has plans under way for two additions, to provide about 60,000 sq. ft. of additional space and to employ approximately 500. The company has contracted with the Durant Motor Co. for closed car bodies for the next 12 months, aggregating about $15,000,000.

Maremont Mfg. Co., manufacturer of motor truck bodies, wagons and automobile springs, 916 South Wabash avenue, Chicago, has bought from the Otis Elevator Co., property on the southeast corner of Ashland avenue and Sixteenth street, which is improved with a one-story factory now occupied by the buyer.

Acme Body Top Co., Chicago, Ill., has been organized to manufacture and deal in automobile bodies, tops and accessories. Capital $3,000. Incorporators: Henry G. Bentson, Hans M. Gastafson, Samuel G. Gustafson.

H. & M. Body Corp., Racine, Wis., will spend $125,000 on the construction of dry kilns at the southwest corner of Center and Eighth streets. It will mean the employment of several hundred additional men.

Carnegie Body and Top Co. has been organized at Cleveland, O., with a capital of $10,000, by Cleveland J. Suffens, Vivian Falls, F. I. Werley, William M. Bassichis, D. A. Lavine.

Herman Kirstein, 2756 Frankford avenue, Philadelphia, manufacturer of wagons and parts, has filed plans for a new one-story mechanical shop at 2777 Emerald street.

Burton Auto Top Co., Woodward avenue and Canfield street, Detroit, has filed plans for a new one-story plant at 60 West Canfield street, to cost about $25,000.

Lincoln Motor Body Co., Toronto, O., capital $15,000, has been incorporated by L. Owings, Arnold Davis, jr., Frank M. Meyer, James S. Owings, Frank C. Foss.

Love & Love Co., Barnes street, Gouverneur, N. Y., manufacturer of automobile truck bodies, is planning for the installation of new equipment.

Kastory Mfg. Co., maker of automobile bodies, La Grange, Ill., plans the construction of a one-story addition, 100 x 125 ft., to cost $40,000.

Peerless Body Corp., Youngstown, N. Y., has been incorporated with a capital of $50,000 by R. D. and N. D. Haskell, C. W. Robertson.

Royal Auto Body Co., 3727 Cottage Grove avenue, Chicago, is planning for the installation of new machinery.

British Auto Industry Far Below Capacity

British automotive factories were turning out only about 10 percent of their capacity production during the first quarter of 1922, traceable to the fact that export markets are so greatly diminished that manufacturers have been forced into almost total dependence on home demand. Many firms have been working even below this 10 percent capacity, and the average was accounted for only through the activity of some of the builders of light cars, which at present enjoy a vogue in the British home market. Builders of heavier and higher-priced vehicles were practically marking time for the arrival of spring orders.

There were distinct signs of improvement in production with the seasonal influx of orders in late February, and a record was reported in some quarters, when the industrial dispute between the Engineering Employers' Federation and the Amalgamated Engineering Union began on March 11. Most of the manufacturers of motor cars and motor cycles are members of the federation, and since the lockout they have been short of toolmakers and fitters, comprising from 20 to 25 percent of their factory personnel. The result of the lockout was an immediate sharp curtailing of output, representing as much as 25 percent in certain plants.

Reports from such important manufacturing centers as Birmingham, Coventry, and Wolverhampton state that unfinished work is lying about the shops, and in order to maintain balance in the various departments working hours have had to be reduced. Some of the factories will undoubtedly have to close down unless an early settlement is secured. Work has continued uninterrupted only in the case of nonfederated concerns.

Statistics indicate that the export trade in motor vehicles today is most unsatisfactory. In the quarter ending March 31, 1922, exports of motor vehicles (passenger cars, trucks, and chassis) totaled 769, as compared with 1,505 for the same period in 1921 and with 1,787 in 1913.

No British Truck Show

The Society of Motor Manufacturers, commercial vehicle section, has definitely decided not to hold a truck show this year. Opportunity, however, will be afforded truck makers to exhibit models suitable for special purposes; for instance, at the Royal Agricultural Show—a national event—and at the Municipal Exhibition. But no chassis may be shown at such places, only complete vehicles.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

1642—A merchant in Canada wishes to purchase a portable chemical fire engine. Quotations should be given f. o. b. port of shipment. Cash to be paid. Reference.

1652—A mercantile firm in Mexico desires to purchase 6,000 to 8,000 pounds of carriage, machine, and tire bolts, of assorted sizes. Quotations should be given c. i. f. El Paso, Tex. Cash to be paid. References.

1656—There is a market in Germany for machinery and cylinder oils, and lubricating oils. Quotations should be given c. i. f. Hamburg. Payment to be made in United States currency on arrival of goods in Hamburg. Correspondence preferred in German. Reference.

1661—The representation is desired by a commercial agent in Spain for the sale of agricultural machinery and tractors.

1666—A mercantile firm in Burma, India, desires to purchase trailers for timber hauling, steam boiler-feed pumps, triplex pumps, rotary pumps, belting, and anti-friction metal and high pressure steam packing. Quotations should be given c. i. f. port of India. Terms: Cash against documents. Reference.

1673-1683—Owing to the lack of space a number of "foreign trade opportunities" pertaining to agricultural implements have been grouped and can be obtained by referring to the numbers given.

1722-1739—Owing to the lack of space a number of "Foreign Trade Opportunities" pertaining to Automotive Products, have been grouped and can be obtained by referring to the opportunity number given.

1741—An agency is desired by a merchant in Canada for the sale of patented specialties relating to hardware lines, automobile accessories, and household articles. Quotations should be given f. o. b. shipping point. Cash to be paid. References.

1754—The purchase is desired in India of light but durable crude-oil tractors, and a complete electric plant for a farm of about 1,000 acres. The power will be obtained from a hydroelectric station 5 miles distant from the farm. Work to be done by cable system. All agricultural operations will be performed, including plowing and threshing. Quotations should be given c. i. f. Indian port.

1760—A firm of general merchants in India desires to secure the representation of manufacturers for the sale of electrical goods, electric motors, motor car and cycle accessories.

1972—An inquiry has been received from a firm in Spain for an agency for automobiles and accessories, lubricants and oils therefor. Quotations are desired c. i. f. Spanish ports. Correspondence should be in Spanish. References.

2011—An agency is desired by a firm in Spain for the sale of paints for automobiles. Correspondence should be in Spanish or French. References.

2179—A merchant in Belgium wishes to secure an agency for an electric automobile, 2 and 4 seater, and spare parts. Correspondence should be in French.

2194-2200—Owing to lack of space a number of "Foreign Trade Opportunities" pertaining to automotive products have been grouped and can be obtained by referring to the opportunity numbers given.

2220—An inquiry has been received from a merchant in South Australia for an agency for farm tractors, preferably of the caterpillar type, and wheeled tractors as well. Quotations are desired f. o. b. New York, or c. i. f. Australian port. References.

2261—A manufacturing company in Canada wishes to purchase artificial leather for automobile-top material, and materials and supplies for jobbers in the automobile-top repair trade. Quotations should be given f. o. b. shipping point. Reference.

2277—A merchant in Spain wishes to purchase paints and varnishes of all kinds. Quotations should be given c. i. f. Spanish port. Correspondence desired in Spanish. References.

2283—A commercial agent in South Africa wishes to secure the representation of manufacturers to cover the Transvaal of a cheap motor tire; and agricultural implements suitable for conditions in South Africa. Reference.

2296—A mercantile firm in South Africa wishes to purchase factory first automobile tires. Quotations should be given c. i. f. Durban or f. o. b. vessel, New York.

2297—The purchase is desired by a mercantile firm in England of 3/8 and 5/16 inch diameter cup square bolts and nuts of various lengths for coach building. The first order will be for 2,000 gross. Quotations should be given c. i. f. port of England. Reference.

2300—A firm in Belgium wishes to secure an agency from a manufacturer for the sale of a windshield cleaner for automobiles. Reference.

2302—An agency is desired by a firm in Italy for the sale of motor cycles. Correspondence should be in French or Italian. Reference.

2309—A firm in Australia desires to secure an agency for all kinds of automobile accessories. Quotations should be given f. o. b. New York. Terms: Cash in New York. References.

2311—The purchase is desired by a city of Canada of a 2½ ton automobile dumping truck, suitable for hauling gravel over dirt roads. Quotations should be given f. o. b. destination or port of shipment. Reference.

2312—An importing firm in Spain wishes to purchase aluminum sheets for automobile bodies and machinery for working said metal, and electric ovens for varnishing and enameling automobiles. Quotations should be given c. i. f. Spanish port. Terms: Cash against documents or letter of credit. References.

2313—The purchase of white mineral oils is desired by a corporation in Italy. An agency is also desired. References.

2361—Automobile supply dealers in Norway desire to purchase and secure an agency for the sale of piston rings (lock joint and step joint). Quotations should be given c. i. f. Norwegian port. Payment to be made through banks in Norway and New York. Reference.

2422—A merchant in Italy desires to secure an agency and purchase pneumatic tires and automobile accessories. Quotations desired c. i. f. Italian port. Correspondence should be in Italian or French. Reference.

2455—The purchase of mineral oils, especially lubricating oil (cylinder oils), benzine, and paraffin, is desired by a firm in Czechoslovakia. Quotations should be given c. i. f. German, French, or Holland ports. References.

The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1, Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3, Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. LXIV. No. 4 JULY, 1922 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3.

The Automotive Manufacturer

A Consolidation of The Hub and Automotive Engineering

Vol. LXIV NEW YORK, JULY, 1922 No. 4

Manufacturing Automobile Body Padels

BY GEORGE J. MERCER

Materials Used for Metal Body Panels—Types of Presses Employed to Form Them—Production of Dies—Advantages of Large Heavy Machines on Big Production Schedules

SHEET steel has come to be used almost entirely during the last 12 years for the panels of automobile bodies wherever quantity production methods are followed. Aluminum is the one other metal used for panels. It is more expensive than steel, but as it is lighter and more ductile, it finds favor where weight is a consideration or where much hand labor is employed in forming the panel. It was these qualities that made aluminum acceptable as the first substitute for wood when automobile bodies made according to carriage practice no longer withstood the severe service to which they were subjected.

Early Use of Sheet Aluminum and Steel

The use of aluminum in the early period increased rapidly throughout the trade, and this demand, together with the needs of other industries, severely taxed the sources from which aluminum was obtained. Consequently, body builders made a practice of ordering their supplies one year in advance, but regardless of this foresight, they frequently had to buy for immediate needs from jobbers who cornered the available supply and charged bonus prices. The unsatisfactory market conditions regarding aluminum compelled the large users to try to find a substitute. A return to wood was not to be thought of and steel was the only other available substitute that could be purchased at a satisfactory price.

Two serious problems faced the pioneer advocates of steel panels: First, there were no large mechanical double-action presses suitable for the work, because similar requirements had never been put up to press builders. Second, with the sheet steel then available it was necessary to heat the metal prior to drawing and forming, in

* Published by special arrangement with the Editor of Machinery, N. Y.

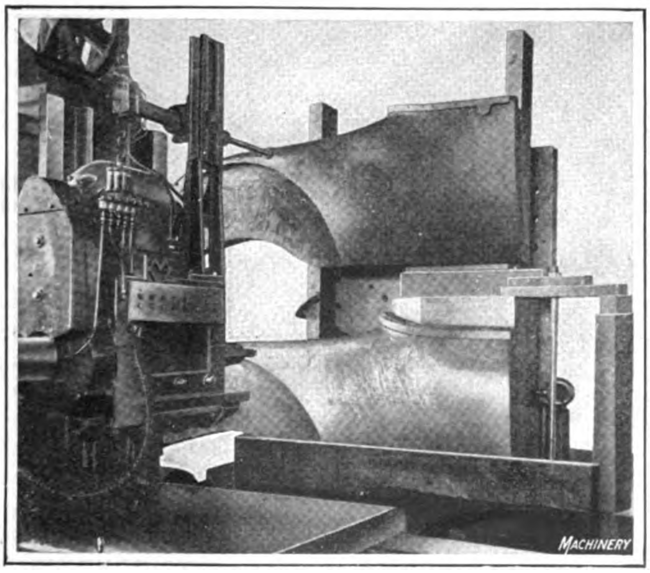


Fig. 1. Machining a large die on an automatic die-sinking machine.

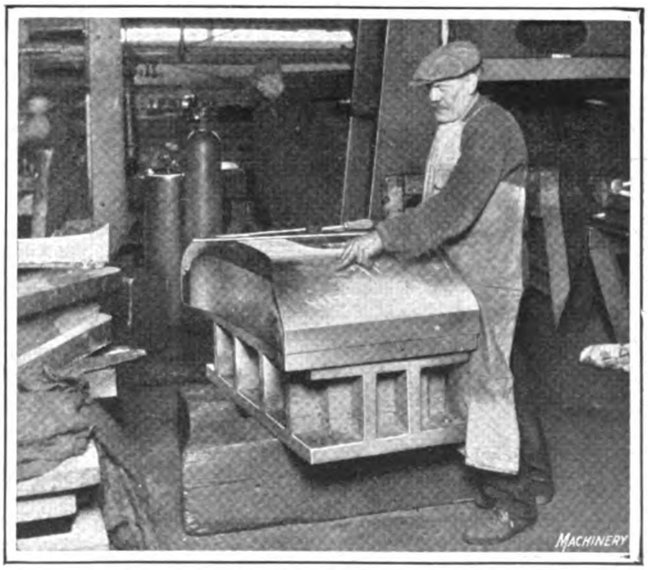


Fig. 2. Hand filing a die after removing it from die-sinking machine.

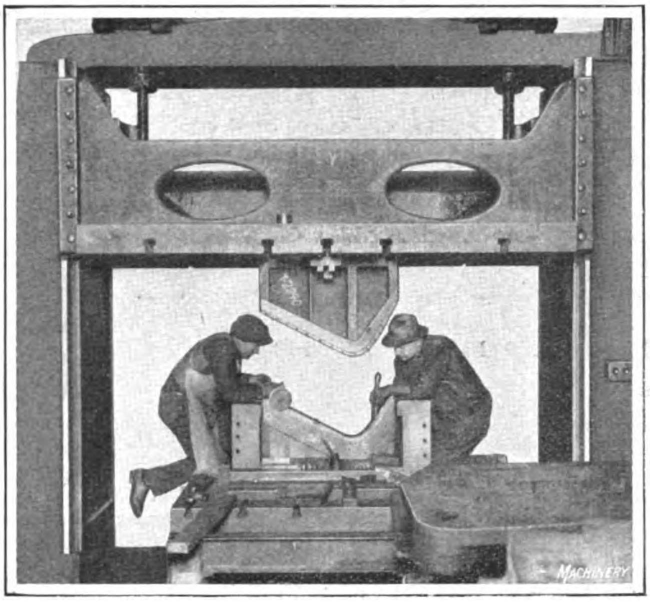


Fig. 3. Matching the male and female die members of a set in an imprinting machine

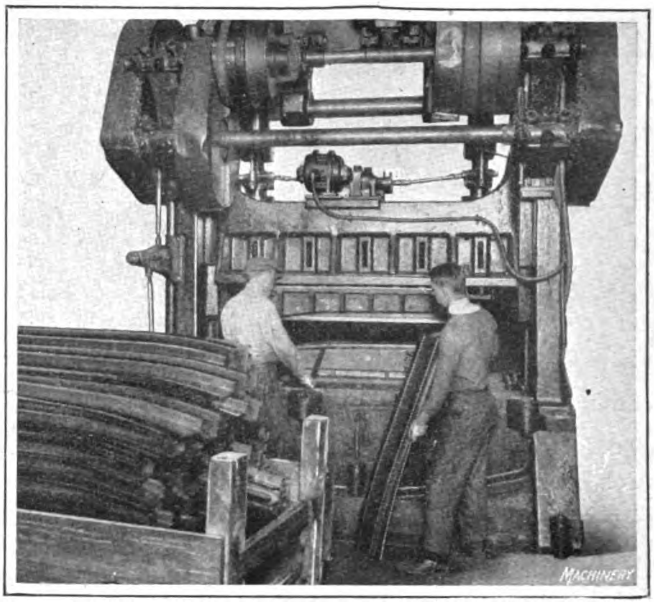


Fig. 4. Forming two body pillar casings together, which are separated in a subsequent operation.

order to prevent it from tearing. Previous work approaching the character of body stampings had been done with dies under a hammer. The metal was also heated in this work, which caused it to scale. After such an operation, the scale had to be removed and the part pickled, and much hand labor was used in finishing and polishing.

Overcoming the Early Handicaps

The impracticability of continuing under such handicaps resulted in the gradual development of the improved machines and material of the present time. For a short period after power presses were developed for this work, sheet steel was pressed while hot. Present-day accomplishments in any modern stamping plant, such as the cold-drawing of wheel housings from No. 22 U. S. standard guage steel to a depth of 6 or 8 in. in a double-action press, would have been incredible.

Quality and Amount of Sheet Steel Used

The steel used is graded according to the character of the work, and is broadly classed as "automobile body stock." It is a basic deep-drawing stock, pickled, annealed, and refined by cold-rolling so that no roughness or pores will develop on the surface in a drawing operation. This last specification is of the greatest importance because any roughness of the steel will show through the paint. Of course, roughness may be removed by hand-filing, but this represents an additional cost which should be avoided, if possible.

The steel most used for panels is No. 22 U. S. standard guage which is approximately 1/32 inch thick and weighs about 1¼ pounds per square foot. Other steels used, but to a limited extent, are Nos. 20 and 18 U. S. standard guage. The amount of steel necessary for a closed body of the sedan type having a wooden frame and steel panels averages 140 pounds. An open body of the phaeton type requires about 100 pounds. The number of pleasure cars that were built in 1921 approximated 1,500,000, and provided two-thirds of this output had phaeton bodies, this would represent a requirement of 50,000 tons of panel stock. The cost of building a sample phaeton body without painting or trimming, averages $400. In quantities of a thousand and over the same body can be produced at a cost ranging from $35 to $70, the metal work in labor and material in each case representing approximately one-third the cost.

The foregoing figures broadly outline the

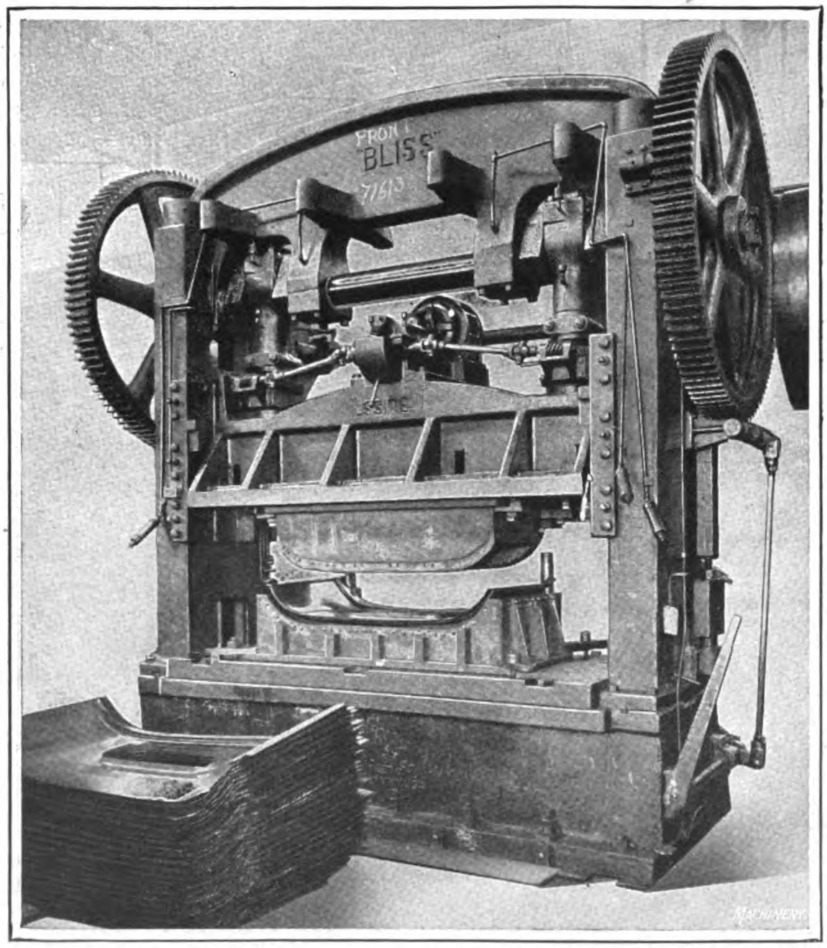


Fig. 5. Trimming and flanging the edges of a sedan body part and blanking and flanging the window.

extent of the automobile body industry. The efficiency of its manufacturing methods depends to a large extent on suitable press equipment for drawing, forming, and flanging the metal in a manner that will leave its surface smooth and true. Hand operations in assembling and finishing are thus reduced to the minimum cost. In the following, some of the methods used in body panel manufacture will be described. The accompanying illustrations were obtained at the plants of the Michigan Stamping Co. and the Clayton & Lambert Mfg. Co., the different examples of press work shown being performed on machines manufactured by the E. W. Bliss Co. of Brooklyn, N. Y.

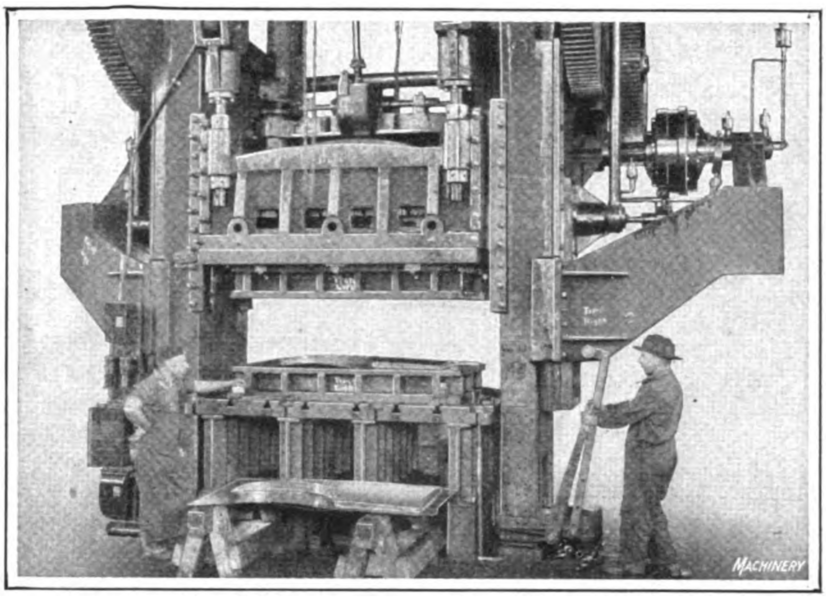


Fig. 6. Toggle drawing press with a 9-in. crankshaft, making wheel housings

The large dies necessary for this work presented a difficult problem at first, as their size and irregular shape made them expensive due to the amount of hand labor involved in making them. The dies are cast, and instead of being filed by hand and ground as formerly, they may now be finished by employing a die-sinking machine. In Fig. 1, a machine built by the Keller Mechanical Engraving Co. is shown finishing the male die of a roadster rear-side panel. This machine is especially designed for handling large forming, stamping, and forging dies.

A master or model above the work and a small roller which registers on the master are utilized to guide the milling cutter on the work. The master can be made either of wood or plaster. As the tracer is moved over the surface of the master, the cutter is moved correspondingly on the casting, with the result that a die that is a facsimile of the master is produced. The tracer touches the master but lightly, so that the surface does not become defaced. However, the tool is held rigidly at every point no matter how slightly indicated by its guide. This machine is electrically controlled through push-buttons. The work can be moved horizontally and vertically, while the cutter has an adjustment for depth. In some instances a two-thirds saving in die cost has been accomplished by using this equipment.

New Machines Facilitate Matching Dies

After the die has been taken from the die-sinking machine, it is hand-filed, as shown in Fig. 2. The final matching of the male and female die members of a pair is performed in the die imprinting machine shown in Fig. 3. This is a machine of recent design which considerably facilitates this work. It affords convenient positions for working on the die, and imprints are easily made. The dies are not taken from this machine until all fitting is completed and they are ready to be set in a press for production. Without such a machine the usual practice has been to hold a press out of production for this work, the imprints being made in the same manner by making a blue mark on one member, then registering the high spots, taking the die out of the press to be filed and finally putting it back for another imprint. Such a method is tedious and laborious, as well as expensive.

The press equipment for making body parts ranges from the large double-crank, double-action toggle drawing press down to the small bench press used in punching nail holes. The presses used for the major operations are of two types classed as single-action and double-action presses, respectively. Both of these types are of the double-crank style, as often the width of the die

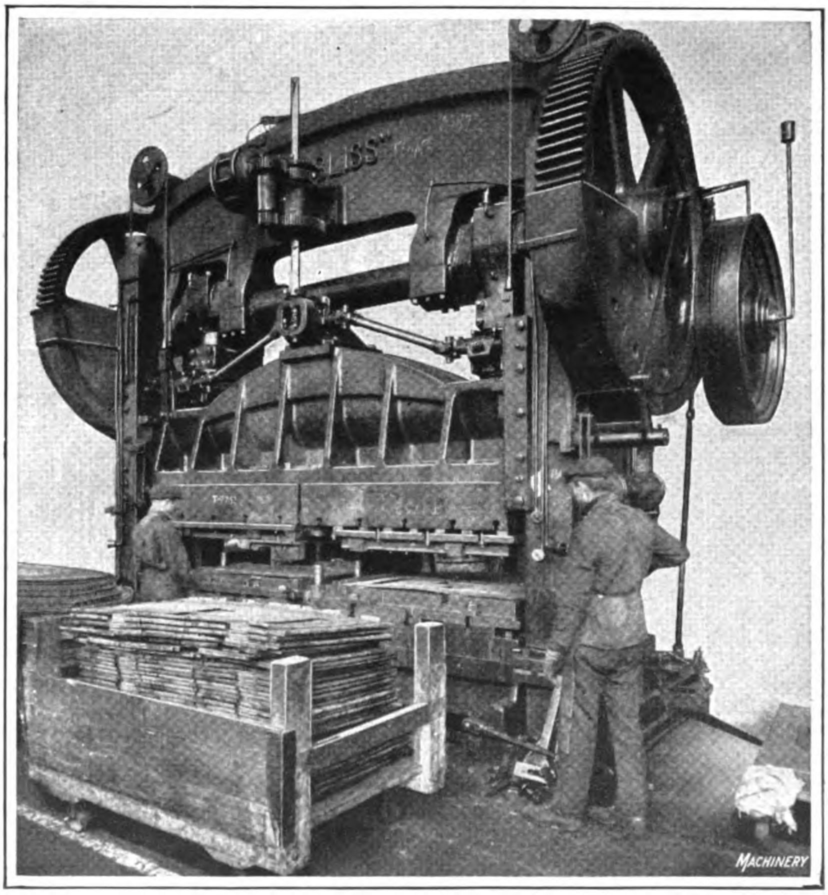


Fig. 7. Large Single-action double-crank press used for blanking and flanging a part at one stroke.

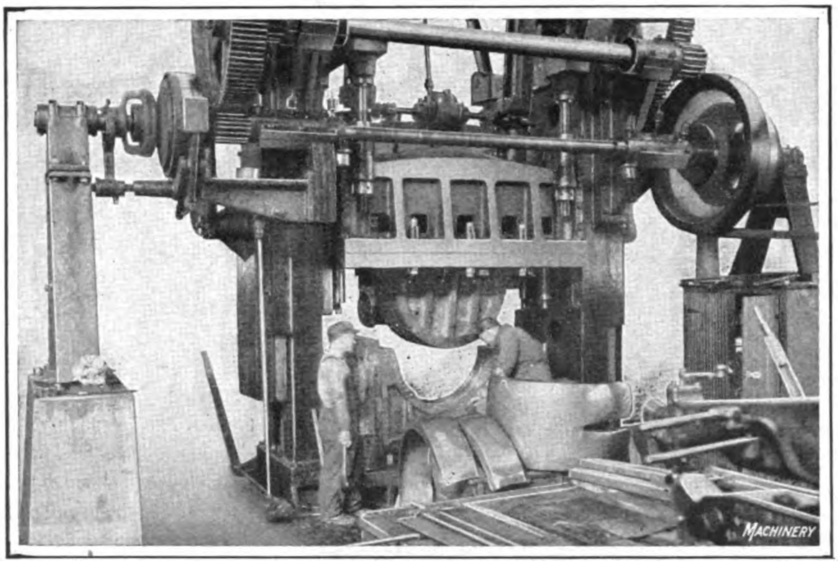


Fig. 8. Another large-sized toggle drawing press making mud guards.

bed permits using two dies. Thus blanking and finishing operations can be performed at one downward stroke of the press. In Fig. 7 a large single-action press is shown supplied with two dies, the one at the left being used for blanking and that at the right for flanging.

Field for Single-Action Presses

Single-action presses are used for shallow drawing and forming and for flanging and trimming. They are made in sizes having a crankshaft diameter of from 6 to 10 in. and a die bed usually of from 84 to 124 in. in width, although sometimes the die-bed width is in excess of the latter dimension. When presses of this design are used for forming and drawing, it is necessary to provide additional equipment for holding the metal under pressure. This may consist of spring drawing attachments or pneumatic die cushions. These devices increase the capacity of a single-action press by enabling it to perform, to a limited extent, the same work as a double-action machine. Figs. 4 and 5 show double-crank, single-action presses equipped with spring drawing attachments. The tools in Fig. 5 simultaneously trim and flange the outside of a sedan body part and blank out and flange the window opening. The operation in Fig. 4 consists of forming body pillar casings, two of these being produced from one blank and separated in a subsequent trimming operation.

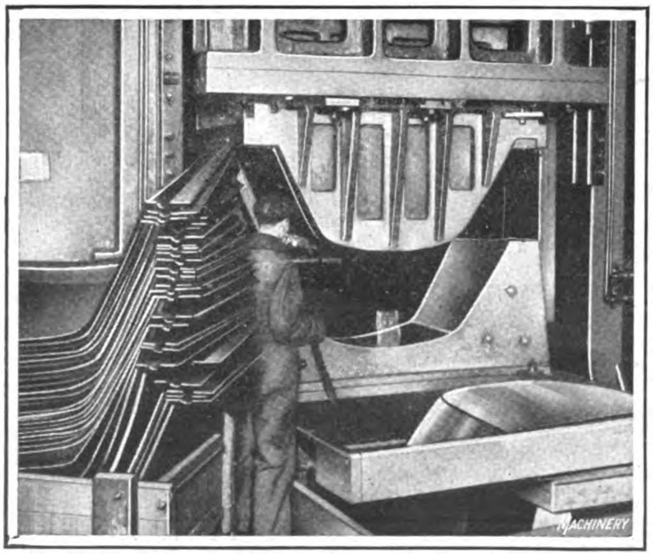


Fig. 9. Close-up view of an operation on a one-piece cowl.

Field for Double-Action Presses

The double-crank, double-action toggle drawing press is used for all the difficult deep-drawing and stretching operations on such work as cowls, wheel housings, mudguards and tonneau backs. Presses of this type are constructed with an inner and outer side, and the working tools consist of three members, a lower die, a blank-holder and a punch. The lower die is fastened to the die bed, the blank-holder to the outer slide, and the punch to the inner or drawing slide. The drawing slide is operated direct from the crankshaft, and therefore has a continuous uniform motion. The blank-holder slide is operated through the toggle mechanism which gives the slide a dwell to hold the sheet-metal blank under sufficient pressure to prevent it from wrinkling or buckling as the punch draws it into the lower die. The amount and distribution of the pressure on the blank means success or failure in deep drawing operations; therefore, blankholder slides are provided with adjustments so that the pressure may be regulated. The majority of presses of this type have a 9-inch crankshaft which exerts a working pressure of approximately 375 tons. The width of the die bed varies from 86 to 120 inches. There are also some presses with 7 or 8-inch crankshafts, used for door panels, aprons, and other small pieces.

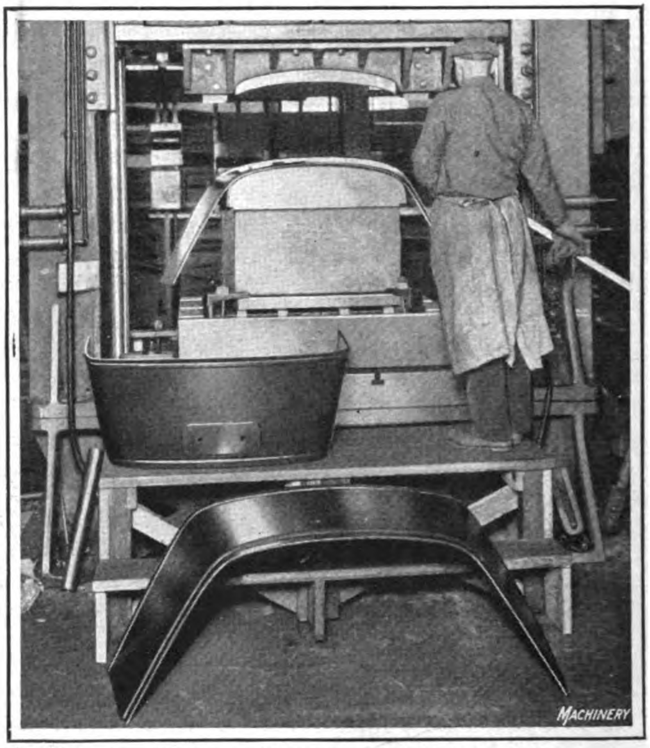


Fig. 10. Another view of an operation on a cowl.

Some Notable Double-Crank Machines

Fig. 6 shows a double-crank toggle drawing press with a 9-inch crankshaft being used to produce wheel housings, and Fig. 8 shows a machine of the same style performing an operation on mud guards. In the latter illustration the operation of pressing a double rear guard has just been completed. Figs. 9 and 10 illustrate two operations on a one-piece cowl. The presses employed are of the same type as those shown in Figs. 6 and 8.

(Concluded on Page 29)

Body Building Works Management

BY F. M. CHARLES*

Methods Which Have Been Successful in British Body Plant—Division Into Sections, Each With Specialized Work—Discussion by British Experts

WORKS organization under all conditions is a subject which is so large and broad as to be impossible of exhaustive discussion, so I am compelled to restrict myself to generalities in the hope that you may gain somewhat of worth from it, and that it will provide a most interesting discussion. If it be true that organization can be defined as the art of obtaining the best result with the least amount of work, it is also true that there are so many controlling factors in the actual establishment of a suitable system that two factories cannot adopt the same methods. It is obvious that, given virgin ground and unlimited capital, the organizer will have a different task than if he has at his disposal limited space and a scanty pass-book. Probably in the first case the attempt to reach perfection will lead him to run the well-known risk of over-organization; while, on the other hand, the impossibility, through lack of funds, to apply elementary methods will lead him to the same disastrous result at the end of his financial year.

In the long experience I have had I can assure you that I have seen as many establishments suffering from the result of over-organization—that is to say collecting useless information and duplicating systems—as I have observed small factories, where everything was left to the memory of a clerk in charge, and therefore in dire need of organization.

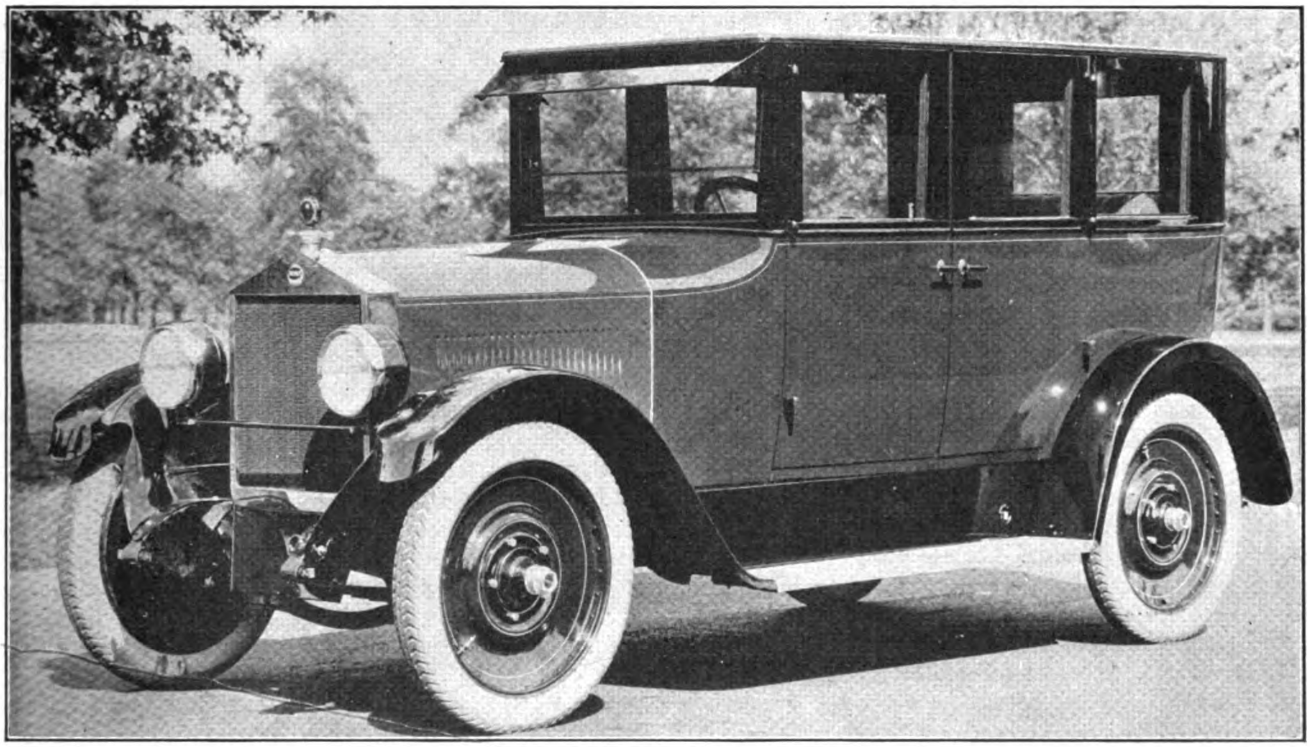
Sets of rules applicable to all cases are obviously impossible. The organizer has to take into consideration not only the size of the factory and the capital at his disposal, but also the class of work intended to be turned out.

The production of bodies of the same type in large quantity calls for a system based on the accuracy of a schedule and is obviously different from the organization suitable to the shop where single orders are the main business.

Let us take an example and we will see that if skill is required to organize the repetition work factory where the production is limited to the faithful copy, by the jig and schedule system, of an article which has been studied with great care, it becomes quite an art when single orders each of different design have to be manufactured, when the personality of the coachbuilder has to be displayed in every detail, and when every carriage has the pretention of being in itself a work of art in which the particular fancy of the customer has to be embodied.

We will therefore assume that we have at our disposal not only the suitable factory but also the necessary capital to defray the preliminary expenses.

In the first place we must have a drawing office. I claim precedence for this department, because the drawing office is the foundation on which we are to build our system and because this important part of any organization, either large or small is too often overlooked or neg-



New Moon sedan body is five-passenger, four-door type. Special lamps, nickel silver radiator and other springhtly features give it a striking and artistic appearance.

* Paper read before the Institute of British Carriage and Automobile Manufacturers, London.

lected. The drawing office is the trunk out of which the different branches of our factory will grow; it is the very spring that will give life to the whole system; on its proper functioning will depnd either success or failure.

The drawing office I have in mind should have for object not only the designing of the article to be manufactured but should also specify the manner of production, and issue to the works the suitable schedule of material

This schedule should be accurate to such a degree as to embody every article used in the course of manufacture, with its quantity and quality, from the timber to the glass, from the leather to the tin-tacks. It will act as a guide which the body will follow throughout its progress from the saw-mill to the delivery department; it will give the buying department the necessary information to enable it to purchase the essential material and no more, it will be the control over our stores by which we may know if our maximum or minimum stock is as it should be, and above all it will be the faithful record giving us the exact cost of the material actually used. It will be easily understood that in order to arrive at such a result by means of a system the whole of which is to be based on the efficiency of a schedule, that such schedule must not only be accurate but systematically drafted.

Let us take, for example, the production of an ordinary landaulette; our schedule will be divided into sections roughly as follows:

A. Body ready for painting. B. Painting. C. Trimming. D. General finishing.

The wings, valances, step-boards and other components will each be alloted a separate section. These main sections I would divide into subsections, as for instance—Section A to include panel-beating, smithy work, preparation of cabinet work, etc.

The question will doubtless arise in your minds as to the reason for these sections and subsections. I trust to make it clear later on, that all this apparent complication has the two-fold object of providing a control over both production and cost of material.

Let us now turn our attention to the stores. We will find that a schedule of material is indispensable to this most important department. To my mind, the danger of running this department without a thoroughly efficient system, providing a daily record of goods received and issued, cannot be over stated. The stores may be likened to a kind of bank in which generally a large amount of capital is invested in the form of goods; that money, we, so to speak, lend to the artisan to transform into goods of a different character—or to pursue the metaphor—to return our capital with interest accrued.

Here the schedule should operate ~~as the~~ basis of the system whereby we can inform ourselves how much of our raw material should be issued for the manufacture of each component, instead of leaving it, as is too often the case, to the caprice of a charge hand. Further, it will reveal accurately the quantity of material which has been scrapped in the course of manufacture and enable us to check this source of wastage; this alone is of no small importance.

Assuming that we are to adopt the plan of manufacturing bodies in sections, our stores must be divided into two departments, one for raw materials, the other for finished articles. In a factory of the kind I am dealing with it can safely be said that 50 percent of the productive labor employed is engaged on work in connection with what we should call finished stores, that is to say, finished components. This labor will not furnish a single part to the shop except through stores; front screens, iron fittings, cushions, blinds, even complete doors made on jig and booked on what is called a stock number have to go through finished stores and then be allocated to one or other of the bodies.

It is therefore obvious that if each component is a separate section in our schedule, the costing of that component becomes a very simple operation, also that the cost of the complete body will be the sum of these components plus the cost of assembling. If I have insisted, perhaps unduly, upon the establishment of a schedule of material, it is because we all realize the importance of control over stores in repetition work, and I feel convinced that were the basis of this system applied to private orders it would be found beneficial.

In addition to this schedule of material, to which I have made such frequent reference, we shall require in order to complete the foundation of our system, a corresponding schedule of labor for each section and subsection. We know for example, the quantity of leather canvas, springs and horsehair necessary to make a cushion, and this second schedule will fix the time or price allowed to the workman to cut out leather, canvas and make up spring cases, etc.

I am afraid, that labor will present a much more troublesome task than material, in the compilation of an accurate schedule.

If we have to contend with fluctuations in the cost of materials these are as nothing compared with the irresponsible vagaries of the shop-steward.

Nevertheless, whatever the trouble experienced at the start in setting up these two schedules, they must be definitely and accurately established if we are to achieve success.

I now propose to make a brief reference to on-cost charge in the computation of which the schedule system will provide a reliable basis.

On-cost charges are of two kinds, direct and indirect; it is easy to understand that the ratio of monthly expenses being compared with the sum of labor spent on one part of the schedule, will give us the exact charges over this particular section. Thus it will be found that the charges incurred by the saw-mill, for instance, are very different from the charges of say, the paint shop.

The over-head charges on the material will be easily calculated for a given period in establishing a ratio between the material actually used for manufacturing, and the expenses incurred in purchasing such material.

I have mentioned before that the problem of organizing repetition work is relatively simple; it becomes complex when the factory is turning out private work, and the wonderful results obtained by members of this society, in the face of enormous difficulties, betoken the exercise of much ingenuity and are a great credit to those concerned.

Reference having been made to personality in coach work, by which I mean design, I hope that I may be permitted to add a few words on this subject, which, to my mind, is as vital as organization itself.

Taking a general survey of the motor body industry over the last 15 years, no one would fail to see that certain changes in design have taken place, but although it is obvious that a new road has been opened to the designer

it is surprising to note the small amount of progress achieved in that direction. Many bodies built 10 or 15 years ago might have been produced yesterday but for their proportions. The engineer has perfected his chassis to a point which permits it to be driven by the most inexperienced, and although many owners and chauffeurs have not the slightest notion of what happens under the bonnet of the car, the number that one meets derelict on the roadside is relatively quite negligible, compared with the number of cars in use. It would seem, therefore, that all the efforts of the motor industry have been concentrated on perfecting the engine, and that the coachbuilder has been more or less satisfied with the improvement of small details, and has taken for granted that the general arrangement of the motor carriage, as adopted at its infancy, was final.

The very same defects that one found in the carriages of the first era still exist in the cars of the present day, and in some cases have been accentuated; for instance, let us take the general disposition of a modern limousine and we will find that about 12 to 15 feet of bonnet, driver's seat, and idle space have to be considered before we arrive at the owner's seat, and where do we seat him? On the very worst spot of the whole carriage, on or behind the back axle! What has become of our old notions of comfort when coaches were suspended by braces on C springs in order to avoid road shocks? The speed was then in the neighborhood of 8 to 10 miles an hour.

We cannot wholly blame the engineers for that. They give us a chassis as they conceived it at the start and, very wisely, they have followed the line of least resistance. We have ourselves to blame for not submitting to them an alternative which would offer the practical side combined with the tradition of British elegance in carriages.

On the question of style, the carriage designer finds himself bound by the same ties which hold sway over the general arrangement and perhaps it is too much to ask him to design a rounded type of body behind the square bonnet of the chassis or vice versa, and to expect that the result will harmonize.

Style in coach work has as much a national character as picture painting. No one could mistake the celebrated English carriages produced 50 or 60 years ago. They were a purely English production; beautiful in their simple lines, they had the British stamp all over and were so universally appreciated that they had an enormous influence over the coach designing of that time.

Now, gentlemen, are we not going away from that beautiful and sound English style? It is not within the scope of this paper to discuss the French or American style or even to examine the value of the actual German freakish fashion, but we must not shut our eyes to the fact that whatever the character of our modern coachwork, it is, to a large extent, neither British in tradition nor national in any exclusive sense.

Is this due to the exigencies of the engineer or to the domination of the mechanical draughtsman? Are we suffering from an inertia caused by the tyranny of a trade technique, or is it merely that the artist has lost his initiative and power of creation?

These are fruitful points for discussion and I should greatly like to hear your remarks thereon.

One of the leading coachbuilders remarked some time ago that most of his productions were guided by the ideas of his customers, and it may be suggested that this is the general experience.

This must necessarily be so to a very large extent, but not, I think, to the exclusion of the personal touch of the artist which should be evident throughout the whole design.

In order to foster the idea of national character in coachwork to which I have alluded, I would like to see established an influential and well-organized coach designing school, which with art in the foreground of its aims, could be counted upon to create fresh masterpieces of workmanship to add further laurels to the already established fame of the British motor industry throughout the world.

Discussion

The president said he was sure, they would agree that they had listened to a remarkably able paper. He was rather inclined to think that they were making a mistake in not having these papers circulated a few days before the meeting, so many important points were involved, that it was almost impossible to grasp all of them. If they saw the papers in advance, the arrangement would have a very advantageous effect upon discussion. He was, perhaps, inclined to criticize the paper a little bit on one point, that though it might apply thoroughly well to large factories where you get repetition work, he was not so sure that it would apply quite so well to small factories, where they got a different type of body in almost every case. With reference to the point, that the chassis makers had made all the improvements and the coachbuilder very little, he could not agree. He thought the coachbuilders had made improvements during recent years. Perhaps these improvements were not so drastic as those made by the engineer, but they could congratulate themselves on advances in the improvements, and the motor body which we saw today was infinitely more graceful, more useful and more comfortable than the body made 4 or 5 or 10 years ago. Mr. Charles had raised the point that the principal seats of the occupants were in the wrong place, they agreed with that up to a point, but he would suggest that they could not easily alter that position of the seats. The steering wheel was in front, you must get in front to drive, and therefore, there was at present only one place to put the other seats. Until they could get the driving arrangement of the car altered, they could not very well alter to any great extent the position of the main seat in the body. He put these suggestions forward, in the hope they might lead to discussion, and not in any carping spirit of party criticism.

Mr. Mussellwhite (London), said Mr. Charles' paper was so much in accord with his own views generally, that he could not very well criticize it. He would like to emphasize Mr. Charles' remarks with regard to the drawing office, and designing part of the work. That point was, after all, as essential, and in some respects, more essential, in a small factory turning out specialized bodies, as in a concern turning out large quantities of repetition work. The designer, if he was a designer apart from an artist, could save them many hundreds of pounds in the work shops if his bodies were set out correctly and to the best advantage. The designer could save an enormous amount of material by avoiding the cutting to waste of the timber. He thought the drawing office, and the man in charge of it, were just as important in the small factory as in the large ones. He was inclined to agree very much

with Mr. Charles' remarks in regard to nationality in design. He could not help feeling, though one did not like to admit it, that our design had been very much influenced recently by American practice. The absolute streamline body was really an American idea, and had been copied very largely from American models. There was this in its favor, that it was thoroughly practical, did not catch the dirt and dust in the road, and was easy to clean. But they as coachbuilders ought to persuade the chassis manufacturers to build a more suitable chassis for the body work. Having regard to the attempts made in this direction by the Lanchester and N.E.C., the speaker pointed out that the British public were very conservative, and they hated anything that was unconventional. Referring to a Daimler car which had driven up to the hotel, the speaker said the insulation of the body from the chassis had been accomplished most successfully, the streamline form being at the same time maintained, this showed what could be done, when thought and care were put into design. When he was a young man, designing for Messrs. Mulliners, he obtained the greatest benefit from a course of machine drawing and construction. With the rest of Mr. Charles' paper he was in entire accord.

Mr. Wells (Nottingham) said they had to ask themselves: "Are we out to make what we sell, or to sell what we make?" Those two questions determined the whole line of program. Where you made and obtained orders for special bodies all different, it was obviously a question of making what you sold, the alternative was the policy of determining on a certain chassis on which to concentrate, and of then going ahead, not with a mass production, but with a batch production, and setting about selling it, obviously the latter method had numerous advantages to the manufacturer, to the trade, and to the consumer, in price, delivery, and many other ways.

Mr. A. C. Penman (Dumfries), said this was a paper full of meat, and they would get a great deal more out of it, when they read it at their leisure than from the first reading. He was afraid that in a great many factories the drawing office began and ended by producing the design. The drawing office ought to produce a detailed drawing with everything in perfect order, and materials and quantities. The method so many small places adopted, of handing the design to the foreman to work on, was radically wrong, and they would never obtain any success in that way. The drawing office was the heart and the soul, the beginning and the end of the success of the business. At Olympia he was showing a cabriolet to a possible customer who, however, said another firm were showing a cabriolet at a much lower figure. He suggested to the customer that he should ask that the other cabriolet be opened and then folded again. The vehicle was in view from his stand and he saw two men sweating over it for 20 minutes, and they did not get it folded. That was a clear case of a design being handed over to the foreman to carry out the work. He had, however, seen factories overorganized to such an extent that they could not pay; what they had to ascertain was what would give the greatest product with the least amount of labor. The speaker advocated improved chassis design, so that the seats could be placed more advantageously. The present design was done with the idea that accessibility of the engine was so very essential, but the seat over the back axle was radically wrong. In the old carriage days their customers were prepared to pay for originality of design; they ought rather to go back to those days, in the direction of encouraging the idiosyncracies of their customers, who were perfectly prepared to pay for exclusive designs.

Mr. Thomson (Leeds) said we had been trying to push our work through the factory, but in America they tried to pull it through. They said a job had to be delivered 3 months from today, and they started from the delivery date and worked backwards, allowing so much time for each operation. He thought the question of individual efficiency as applied to particular jobs was only a question of the skill of the draftsman, and extent of his knowledge in the practical side, of the business.

Mr. Lawton Goodman (London), said he entirely agreed with the tenets which Mr. Charles had set up, but he thought the principles outlined would be too expensive a proposition for coachbuilders turning out from 30 to 40 bodies a year; it would be over-organization, and the business would never carry the burden. You could only apply Mr. Charles' system to batch production, and although the drawing office, and all the tenets set up so ably by Mr. Charles in his paper were applicable to the rank and file of manufacturers proper, there were throughout the kingdom some makers whose output was so small that the application of these lines would be over-organization. Mr. Goodman expressed the view that it was the coach builders who had brought about a great deal of the improvement in chassis design. The progress, the comfort, and the ease of the motor car had emanated from the minds of the coachbuilders. As to the suggested consultation between the chassis manufacturer and the coachbuilder, with a view to increasing the comfort of cars, the speaker pointed out that throughout the world there were huge stocks of motor cars, and there was some difficulty of disposing of them.

Mr. Couch (of the Daimler Co.) referring to the suggestion that a new type of car could be designed, agreed that conventionality was a difficulty, but said the chassis manufacturer was out for business all the time, and would be quite willing to vary his design with regard to the position of the engine, and so forth, if he received the necessary help from the carriage builders. But on what ground could they ask chassis manufacturers at large to do away with the engine under the bonnet, as it was today and thereby definitely lose business? If the chassis builder was to push a new type of chassis, the coachbuilder would have to educate the public; as large numbers of people were willing to pay from £2,000 to £4,000 for a complete motor car, it was quite evident that they would be willing to pay for originality and clever designs by the carriage builders.

Mr. Shinnie (Aberdeen) said you had to keep your draftsman in check sometimes; draftsmen read a lot of trade journals, and so they were inclined to put in ideas of their own. The alteration of certain lines in a drawing sometimes saved hundreds of pounds in the manufacturing of the product. He ventured to think that there would be a very big change in chassis design in days to come. The present system was altogether wrong, and so involved, that of the power you originally developed, you got only from 15 to 20 percent on your road wheels. The loss of power was terrific; he looked forward to the time when the engine would be of totally different design, and the old indictment of a motor engine "a bark like a dog's" "and smell like a cat" could not possibly be applied. (Laughter and applause).

Development and Future of Motor Truck Freight Handling

BY F. W. FENN*

Present Situation at Our Freight Terminals—How Motor Trucks Will Improve It—Better Highways a Big Aid—Motor Trucking Will Increase Country's Production and Wealth

COMPETENT judges estimate that the truck business is in its infancy, and that its future development and extent are beyond the conception of business men of today, judging from its position today. When the statement, made by a responsible government authority** that this year's motor truck tonnage will exceed 1,440,000,000 tons and that this may be more than one-half of the railway freight tonnage is considered fully, in conjunction with the thought that we have a population of 110,000,000 to serve, that this is growing at a rate exceeding 1,000,000 a year, that we have 2,133,000 miles of highways available for truck use, and only 226,000 miles of railroads, that the highway mileage is increasing each year while the railroad mileage on the other hand is decreasing, it appears that any big future estimate of motor truck transportation is not ill-founded. These basic facts make almost any estimate a possibility.

Taking up the whole transportation system of the country, our highways, railways and waterways are the arteries through which our commerce, the life-blood of the nation, flows between points of production and final utilization or consumption. Commerce could not exist without transportation of some kind, and the extent of that commerce depends upon the range, quickness and flexibility of transportation. It cannot expand any faster than our transportation facilities will allow.

The greatest strain appears to be at the terminals. Statistics show that if the junction and terminal delays could be eliminated the daily average mileage could be brought up to 37½ miles per railroad car, which would be the equivalent of an addition of 1,200,000 cars.

At such centers of population and manufacturing as New York, Cincinnati, Minneapolis, Cleveland, Louisville, Grand Rapids and St. Louis motor freight terminals are established. These exercise important influences on transportation and production immediately. In the city of Cincinnati alone 66,000 cars were released for the through traffic; shipments that took four days by cars from one part of Cincinnati to another, were transferred by motor truck in four hours. Thus, we see that the motor truck may be used by the railroads themselves with great profit, and an increase in the range, quickness and flexibility of the over-all service.

These are vital points in steam rail operation in that they are generally seats of financial loss and are a source of burden to the operating departments. They may however, be turned into revenue producing factors by the adoption and widespread use of the motor truck. That perhaps may look like a broad statement, so we will proceed to show how and why it is true.

Daniel Willard, president of the Baltimore & Ohio Railroad Co., says that experience of the past demonstrates clearly that at least $1,000,000,000 per annum must be provided as a minimum for capital expenditures for new equipment and facilities necessary to keep the railroads abreast of the transportation requirements of the country. If we are to have, in his opinion, a complete and well articulated national system, it can only be had, as things are now, by the coordination of a number of different transportation agencies, including steam and electric railways, the utilization of coastwise and inland waterways, the full economic use of the highways, improved and unimproved, the use of the motor truck, and such other transportation agencies as may be best suited to the particular requirement.

* Sec'y Nat'l. Motor Truck Committee, N. A. C. C. Delivered before Engineers' Club of Philadelphia.
** U. S. Committee on Reconstruction and Production.

Railway and Highway Mileage

Conditions of the immediate past bear out Mr. Willard's statements on these points. The fact that we have in this country 259,000 miles of railway and 2,753,334 miles of highway, of which 296,290 miles are improved, clearly proves that vast sections of the United States are today without any form of transportation, and are, therefore, either operating under their production capacity or are not producing at all. This is an economic waste, for within this area of non-producing territory lies a vast acreage of productive soil, capable of adding materially to our agricultural wealth, nor should we forget the great mineral deposits which are unavailable, due to their state of isolation.

Since the coming of the motor truck, however, much of this mineral wealth is now being unearthed and turned to good use for the nation. These socalled "motor truck" mines are yielding coal, iron, copper, lead, zinc, gold, silver, salt, sulphur, mercury, graphite, corundum, phosphate, manganese and fluor spar. Of the 4,000 coal mines in the country, 2,000 are without railroad connection and use either motor trucks or horses to move their product. Of the 5,000 precious and semi-precious ore mines in the country about 2,500 use motor trucks.

At Terre Haute, Ind., coal is being hauled directly from the mine to the consumer. The mines are seven miles east of the city and are owned by the coal dealers. Due to the fact that this operation lies within the "short haul" sphere, the truck was able to cut the delivery time from weeks (by railroad) to days.

The Civic Association of Birmingham, Ala., has contracted with a motor truck company to move coal direct from the mines to the consumer at the rate of 200 tons a day.

Truck May Open Up New Country

If the motor truck is able to make productive mineral deposits lying within a "short haul" radius of 50 miles of any consuming community, or, if through its ability to penetrate into sections where it would be impossible or impracticable to lay steel rails, it is creating tonnage as a feeder to our railroads, it becomes at once a necessary part of our transportation structure and should be adopted as one of the features of it.

In all parts of the country a vast tonnage is forwarded in less than carload lots (l.c.l.) to neighboring towns and cities. Upon investigation, it would probably be found

that it is cheaper to ship such goods by motor transport. It is certain that were motor transportation employed in handling this class of goods, the shipping cost would be lower and the transaction, a door-to-door over-night delivery, whereas the rail line might require two or three days to accomplish the same service. It should be borne in mind that in shipping l.c.l. short distances, four to five handlings, cartage at both ends, and, in many cases, packing and boxing, are eliminated. These are items well worth considerable thought, for they must be included in the rail freight rate.

Excessive Costs for L-C-L Shipments

A brief recently submitted to the United States supreme court in a railroad case says that the terminal cost of handling less-than-carload freight in 1916 was slightly less than 5 cents per hundred pounds at each terminal, or double that amount for the two terminals. Since 1916 this cost has increased more than 100 percent and in 1919 the cost of handling freight at 15 stations in Central Freight Association territory ranging in size from Cincinnati to a town of 100 inhabitants, destined to three large stations in trunk line territory, was 22 cents per 100 pounds. This means that at the present rate of 25 cents, first class, five miles, per hundred pounds, it is necessary to haul the average less-than-carload tonnage 40 miles to break even on 80 percent of the actual costs, leaving nothing whatever for profit, taxes or interest on investment.

Edward Hungerford states that old-time railroaders for years past have said that a freight car did not begin to make money until it had hauled its goods at least 40 miles; today the modern generation of operators will come nearer to putting this figure at 80 miles. Up to a distance somewhere between these figures—and undoubtedly far nearer 80 than 40—the vast terminal charges of the American railroad nullify the profit of the haul itself. This is a principle of rail transportation so well understood by all competent authorities today as to be open to no dispute whatever.

Local package freight comprises over 100,000,000 tons annually, or over 4 percent of the aggregate tonnage of the railways, although from the nature of the service, the revenue received from this traffic and the cost of handling it, bears a much larger ratio to the total earnings and expenses. Approximately one-half of this freight originates at a point on one road and moves to a point on another road. Such freight must be transferred by the originating road to the receiving line at a junction point at its expense, being frequently interchanged several times before the shipment reached its destination. This interchange is now made either by movement from one freight house to another by trap cars, or by trucking directly across the city.

As indicative of the magnitude of this interchange movement, an exhaustive investigation of the traffic handled in Chicago a few years ago, showed that over 6,500,000 tons of less than carload freight passed through the forwarding freight house in that city annually, of which about 60 percent, or 4,000,000 tons was received in interchange from other roads. Apprixomately, one-half of this interchange freight, or 2,000,000 tons, was trucked across the streets from one freight house to another while an equivalent amount, or approximately 6,500 tons daily, was moved by trap cars. Owing to the relatively light loading of cars which package freight necessarily requires the drain on the terminal capacity of the roads participating in this switching movement is self-evident.

Terminal Capacity a Big Problem

One of the primary problems in almost all terminals now, is that of adequate capacity. It has long been realized that the greatest efficiency in railway facilities is at the terminals and the experiences of the last three years have demonstrated repeatedly that the capacity of the roads is fixed by that of their terminals. Therefore, any means by which the present burden may be lightened, makes possible a corresponding increase in the volume of other freight which can be passed through the terminals and in like manner increases the capacity of the railways as a whole. One means by which the terminal capacity may be increased is by relieving the terminals of the switching incidental to the transfer of this less than carload freight in interchange, by substituting the use of motor truck for that of cars. That this will afford no small saving is indicated by the experience at Cincinnati, where the substitution of motor trucks for trap cars in the transfer of interchange freight, aggregating about 660 tons daily, has released nearly 200 cars from continuous trap car service and eliminated approximately 300,000 switching cuts annually.

While the removal of this traffic from the already overtaxed rails of the terminals is the most important consideration, investigation probably will show that much if not all of this freight can also be handled by motor trucks at equal or less cost than by present methods, considering out-of-pocket or direct transportation costs only. Another important consideration is the reduction in the amount of time which will be required for such movements, the use of motor cars in Cincinnati effecting a reduction of 52 hours in the average time required for interchange. In view of these showings, the motor truck warrants careful consideration from operation officers as a facility for their use in increasing the capacity of their terminals, in reducing the cost of their less-than-carload interchange service, and in expediting it and thereby promoting the interests of the shipper as well as their own.

Truck Valuable During Strikes

During strikes and other disturbances, motor trucks have proved themselves invaluable in relieving congestion, and became at once a dependable and valuable ally of our railroads. This has been well demonstrated at New York and Chicago. With their incoming and outgoing food and fuel supplies blockaded by the recent strike of railway switchmen, and a walkout of locomotive firemen and engineers, which forced an embargo on virtually all freight shipments, Chicago and smaller nearby cities and towns faced the most crucial situation in years.

In the Chicago stockyards, packers established an emergency motorized freight service to get provisions to the districts cut off by the strike. A fleet of 50 trucks was placed in operation between the yards and Racine, Elgin, Aurora, Gary, Waukegan, Kenosha and other towns. Spectacular scenes followed the installation of this service. Through all hours of the day and night, streams of these trucks shot away from the warehouses and loading platforms of big packing concerns and plied their way through city streets and over country roads with their heavy loads of provisions.

Perhaps even more noteworthy was the unprecedented relief afforded by the Citizens Trucking Committee, an organization formed at the instance of the major com-

mercial organizations in New York City, to combat the strike of 44,000 truckmen. In just four and one-half months, the company moved 19,950 tons of freight with the aid of a few outside truckmen. If this tonnage had not been carried, can you picture the plight that thousands of consumers would have been in? The motor truck saved the day again!

Future of Motor Trucking

The early history of the Ohio and Mississippi rivers is full of romance delightfully couched in scenes and episodes that were a part of plantation life in the south before the war. The days gone by witnessed many a contest for supremacy in races among packets, that have long since disappeared, when commerce was at its height.

Some day commerce will again flow over the bosoms of these mighty rivers and their pristine greatness will again be reflected in a new atmosphere of prosperity. However, before this can come about, new terminal facilities must be provided. Conditions such as those existing at St. Louis and Memphis, must be changed for more modern methods of loading. At these points, we can still find negroes at work carrying the river boats' cargoes on their heads over the gangplanks. I can see a vision which has a glorious future for these old rivers. I believe the time is coming when we will see fast steamers, receiving their cargoes from railway cars at their sides and from motor trucks through well-equipped terminals.

I believe it is well within the possible to prophesy that the future will witness merchandise manufactured in cities lying within a radius of from 50 to 100 miles of the Ohio and Mississippi terminals, loaded in demountable motor truck bodies, or containers, sealed and billed through to South American markets, moving by motor express and fast river steamers to gulf ports, there to be transferred to the holds of steamers and through to destination in the original package or body. If we are to bid for and successfully hold the confidence and patronage of our South American neighbors, we must send them only such goods as the customs of the people demand—in other words, we should make our products to fit their racial and climatic demands.

Many Ports Better Than a Few

Then again, we should not allow port tie-ups to delay the free and easy movement of commerce. A nation of the magnitude of the United States that develops one great port expecting to receive and clear through that port the great bulk of its commerce, as we have done in the case of New York, neglecting such ports as New Orleans, and Mobile, cannot hope to cope with other nations. The bulk of South American trade rightfully belongs to us and it is ours if we will but develop and hold it. Selling South America at a time when foreign competition is broken down is not building a market for the future, but is rather, taking advantage of conditions. If we could restore commerce to the Mississippi and Ohio Rivers feeding it by rail and motor transportation, it would relieve the port of New York, and by sending shipments through to destination in sealed bodies or units out of New Orleans or Mobile, transportation costs could be greatly reduced and the cost of selling materially lowered.

Good Roads a Necessity

Good roads are necessary to the advancement of highway transportation. They should be paid for by the public and maintained by income received from those using them; but they should be built to serve the needs of commerce that exist today and not to the demands of 20 years ago.

In building highways, let us follow the policy of the railways in building to the demands of the traffic, for therein lies economy and prosperity.

The British ambassador in a speech at Atlantic City before the United States Chamber of Commerce, referred to the American people as "One of the two or three great nations—great forces of the world."

We are great because we have followed courses and adopted commercial and national policies which have been based in sanity and justice; but if we stumble on our good roads policy—that of building to the needs of commerce and military necessity—we are falling down on one of the biggest problems that have ever come before us as a nation.

Standardization of Door Latches

The following suggestions were offered by W. H. Ritter, second vice president and sales manager of the English & Mersick Co., New Haven, Conn., at the convention of Automobile Body Builders Association, Detroit, Mich., June 21:

1. I am grateful for the opportunity given me at this meeting to call your attention to the standardization of door lock levels.

2. During the past two years we have been asked to furnish locks with bevels ranging from a right angle to 12 deg. with two additional sizes ending with ½ deg.

3. This range of sizes places on the lock manufacturer what I believe to be an unnecessary burden and adds very considerably to manufacturing costs—every penny of which is now being analyzed in an effort to make minimum prices. Carrying out every individual idea in lock construction tends to make a jobbing shop out of a manufacturing plant. To secure the necessary bolt throw with bevels widely different, 3 or 4 sets of patterns and tools are required for the bolts, cases, covers and other lock parts.

4. The firm I am with has brought out two new locks during the past 10 months and we have endeavored to establish convenient standards of bevels. Before building the necessary tools, the matter was discussed with three body engineers who were on standards committees. These discussions brought out the opinion that it would be a forward step to make the closed body locks in two bevels 6 deg and 9 deg. Given a tolerance of 1 deg., these two sizes will fit doors with bevels of 5 deg. to 10 deg. inclusive; i. e., a 6 deg. bevel lock will accommodate a 5 deg., 6 deg. or 7 deg. door and the 9 deg. bevel lock for 8 deg., 9 deg. or 10 deg. doors.

5. I am sure we will all appreciate definite standards on bevels, and I may say that in placing this new lock with 15 different manufacturers, the two bevels of 6 deg. and 9 deg. have been entirely satisfactory.

6. For open bodies I find a 5 deg. bevel lock which will serve on doors of 4 deg., 5 deg. or 6 deg. is satisfactory.

I respectfully urge the consideration and early decision by the standards committee on bevel, if satisfactory.

French automobile manufacturers are showing special interest at present in the four-wheel disk brake, and many of the passenger cars are being equipped with this type, which is proving very effective.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	\$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIV JULY, 1922 No. 4

More and More Motor Cars

THERE seems to be no end to the number of motor vehicles which this country can and will absorb. Every time a strongly pessimistic utterance is made as to the near approach of the saturation point, some new development permits lower costs for a given quality of car, and lo, an entirely new stratum of buyers is uncovered. More intensive selling too, is developing many thousands ot new car buyers, people who had not been considered previously as such.

The authoritative figures of the N. A. C. C. for the six months ending with June show that this year's rate of production even allowing for the summer dullness and the usual smaller fall business, will approximate 2,100,000 as compared with 1,668,000 in 1921, and 2,205,197 in 1920, which later stands as the high record of the industry. If the various strikes now pending and in force continue long enough or materialize, as the case may be, it is quite within the possibilities that the record may be equalled or exceeded. Any cessation of rail transportation immediately brings forth new buying of both passenger cars for personal transport, and of trucks for goods transport.

A nice feature of this year's business to date, that is from a manufacturer's standpoint, is that the percentage of new or first-time buyers is unusually large. One big company reports that 40 percent of the May sales were to people in this class.

Prices Receding Again

WHAT may well be another round of price reductions was started June 30, when the Hudson company announced a reduction on Hudson and Essex models. It is true that this was small, amounting generally to \$50, and \$100 on the Essex cabriolet, but it had the usual result in that it has now been followed by Dorris with a more substantial reduction, and Pierce with the very substantial reduction of \$1,750.

More than this, there are large rumors going the rounds that all the lower priced cars will be obliged to follow the Essex lead, all the medium priced vehicles that of Hudson and to a lesser degree and in a slightly higher-priced group of Dorris, and all the high priced motors that of Pierce.

However much of this may be true, it happens that these rumors mark the first break in the very nice brisk business which has been enjoyed by practically all companies since early spring. It is possible that these cuts were but anticipations of the forthcoming summer dullness, an effort in fact to forestall it, but if they have the usual result of every price cut started in the last two years, that is of starting all competing and near-competing makes on downward revisions, it will unsettle the industry to a marked degree just at a time when prophesies are being made of the best of recent years, second only to the record year 1920. Without the third and fourth quarters of the year, these prophesies cannot come true.

Gasoline Stocks Still Decreasing

IN THE face of the largest crude oil production on record, as well as the largest production of gasoline the country has ever known, the stock of motor fuel in storage was decreased by approximately a million barrels or 42,000,000 gallons during the month of May. This is usually a heavy touring month, but June is very much heavier and July heavier than either, being equally also by August. That is, in the face of the tremendous production, the first real touring month of this year used all the production and cut into storage by the amount mentioned, besides.

This is the fuel situation summed up in a few words, and it is scarcely one to which automotive manufacturers and those with heavy investments in the future of the automotive industry can look with pride. This is only a left-handed way of saying that we will very shortly have to have a new kind of fuel, even if at the start it is but something to mix with present-day motor fuel or gasoline. And the sooner we realize this, the better.

Employment Service of Engineering Societies

The Four National Engineering Societies, the offices of which are at 29 W. 39th street, New York City, probably maintains the best free employment bureau connected with any industry or profession in the United States. Members of many affiliated societies and organizations are available through this service bureau, so that it is in fact a national clearing house for engineering talent of all kinds.

The bureau has advised Automotive Manufacturer that members of their subscribing firms who are officials of or connected with organizations in which a central personnel department is not maintained, are at this time given a cordial invitation to make free use of the bureau by advising the various departments in their organizations of the existence and usefulness of the Engineering Societies Employment Service.

The bureau is in a position to furnish civil, mechanical and electrical engineers and designing engineers, production and sales engineers, and executives.

The administration of the bureau is in charge of W. V. Brown, manager, Employment Service, Engineering Societies building, 29 W. 39th street, New York City.

Automotive Exports Indicate Revival of Business

Great Increase in Recent Months Over Last Year Shows that Business the World Over is on the Upturn

ONE of the things this country wants and needs right now is more exports to insure the prosperity of the country, that is to stabilize manufacturing and thus insure a continuance of whatever prosperity exists now as a minimum. In the automotive field, more exports are greatly needed, perhaps more so than in any other field of endeavor because of the tremendous war-time expansion of automotive outputs, and the consequent very large equipment and capacity for production now available.

That general business exporting has turned the corner and started up is widely admitted. The export figures for the month of May show a total of $307,688,622, as compared with $329,709,579 in 1921. That is to say May was a very good month, practically as good as last year. For the 11 months ending with May, there is a different story. This year the 11 months' period showed a total of only $3,436,225,912 as compared with last year's $6,179,611,427. That is May indicated a decrease of but 8 percent, while the 11 months period showed a drop of 45 percent. This would indicate that most of our worst months were behind us. In general, Europe and Asia continue our best customers, the decreases being small. South America shows a drop of 67 percent, Oceania about 55, and Africa approximately 65.

Definite Signs of Business Upturn

In the automotive field, the definite signs of recovery of exporting began even earlier than the leaders expected or believed possible. Following a study of the exports of recent months, it is now felt that much foreign business in automotive vehicles is going to come our way at a very early date, and continue for a long time. Price changes in the last year have shown a downward trend for low-cost vehicles, officials state, but at no time has the total value of exports of American cars and chassis been as low as the low figure of last year, that is $2,187,000, recorded in July, 1921.

A compilation of the passenger and commercial vehicle exports for the ten months beginning in July and ending with April, 1922 and 1921, shows that the exports for the current fiscal year are down 75.1 percent from the value for the corresponding period the preceding year. An even greater decline is indicated when the record is contrasted with that two years ago. The quantity decrease amounted to 96,705 cars and the chassis to 35,331, or 63.2 percent.

In the following table the export picture of the 10 months in these two years is shown in concrete form (last three figures omitted):

Ten Months Ended April			
1922-21		1921-20	
April	$5,533	April	$3,743
March	4,443	March	3,226
February	2,962	February	5,117
January	2,528	January	9,409
December	2,851	December	15,235
November	2,211	November	20,078
October	2,707	October	18,724
September	2,351	September	15,585
August	2,699	August	17,164
July	2,187	July	19,654
Revised total	$30,483	Revised total	$126,942

With the value of April, 1922, exports the highest since January, 1921, representing a figure third to a half higher than many other months, specialists in the export field hold that subsequent months should show a continuation of the steady upturn. The largest April gains were accomplished in exports to Canada and Australia, but out of the 30,120 gasoline passenger cars exported in the fiscal year so far as reported, Mexico purchased 5,376, Canada 5,352, Australia 5,294, Belgium 1,361, United Kingdom 1,241, Japan 1,094, Cuba 872 and Sweden 841. The detailed analysis shows that exports to the United Kingdom were 6,900 cars less than a year ago, while sales to Canada exceeded by $2,100,000 the value of lower class shipments to Mexico and Australia.

Mexico also led in the number of motor trucks exported to her, but the number, 889, represented a value of $564,656, which was just half the amount paid by Canada for 807 trucks. Japan's imports of Americans totaled 640, the United Kingdom imported 807, Australia 432 and the Netherlands 266. France's imports in 1920 were shown as 1,392 motor trucks and 839 passenger cars; in 1921 imports were seven trucks and 339 carriages. The current exports to her are not specified.

In the domestic trade officials state that all passenger car plants are still operating at full speed and truck factories are steadily increasing their output. Many companies say they have on hand sufficient orders to keep them going at the present rate for from one to three months and the makers of several of the more popular lines are reported as far behind on deliveries.

Look for Purchases by Farmers

A large quantity of automotive equipment will be purchased by planters and farmers in the south and other centers of great agricultural activity as soon as the harvests are well under way, according to reports just received. Sales of tractors and other agricultural machinery also are steadily mounting.

In the northwest, the reports state, sales of motor vehicles in May broke all records, but with the beginning of June there was something of a recession in demand, a condition which is expected to continue until the harvests. Indications are, however, that June will be another month in which production will pass the 200,000 mark, although the total promises to be slightly less than in May when it stood at 252,000.

Money Saved by Railcars

But the recent expansion in the automotive industries is not alone confined to the vehicle field, it is shown in a survey of existing developments. An announcement which created wide interest in financial circles recently was the statement from the National Automobile Chamber of Commerce that nearly $14,000 annually will be saved by the Union Transportation Co. of New Jersey through the substitution of motor rail car equipment for its steam locomotive and coaches. The new equipment will be used on the company's run from Hightstown, N. J., where it connects with the Amboy division of the Pennsylvania railroad, to Pemberton, the southern terminus,

(Continued on Page 29)

where connection is made with the main line of the Pennsylvania.

Other railroads that have recently made similar installations of motor rail equipment in the interests of economy are the New York, New Haven & Hartford; Great Northern; Cleveland, Cincinnati, Chicago & St. Louis, Baltimore & Ohio; General West Virginia & Southern; Gilmore & Pittsburgh; Pittsburgh & Susquehanna and the New Mexico Central. In all about 35 carriers are using the equipment.

Merger of Nine Companies in New $80,000,000 Corporation

Associated Motor Industries, the merger which has just been perfected by makers of seven different cars and trucks, has organized for $80,000,000 under the laws of Delaware, with its central offices at Dayton, O. Nine manufacturing plants in seven states, with five assembling plants, 14 in all, are included in this first group of Associated Motor Industries as follows. Four others manufacturers soon are to be taken in and their names are expected to be announced within a short time:

National Motor Car and Vehicle Corp., Indianapolis, Ind.; Manufacturer of National cars and trucks; Covert Gear Co., Lockport, N. Y., manufacturer of all types of transmissions, clutches and car controls; Recording and Computing Machines Co., Dayton, O., manufacturer of ignition systems, magnetos, starters, battery systems and generators; Jackson (Mich.) Motors Corp., manufacturer of Jackson automobiles and trucks; Kentucky Wagon Manufacturing Co., Louisville, Ky., manufacturer of the Dixie Flyer automobile, wheels and truck bodies; Saginaw (Mich.) Sheet Metal Works, manufacturer of all sheet metal parts for automobiles and trucks; Traffic Motor Truck Corp., St. Louis, Mo., manufacturer of traffic trucks; Murray-Tregurtha Corp., Boston, manufacturer of gasoline engines; H. F. Holbrook Co., New York, manufacturer of automobile bodies.

The officers of the corporation are: Chairman of the board, Will I. Ohmer, president, Recording & Computing Machines Co.; president, Louis Ruthenburg, formerly general manager of Delco Light plant of General Motors Corp.; vice presidents, A. A. Gloetzner, president, Covert Gear Co.; Robert V. Board, president, Kentucky Wagon Manufacturing Co.; T. C. Brandle, vice president in charge of merchandising of Traffic Motor Truck Corp., and George M. Dickinson, president, National Motor Car & Vehicle Corp.

In addition to the officers, members of the board of directors are as follows:

James R. Duffin, president, Inter-Southern Life Insurance Co., Louisville, Ky.; H. G. Stoddard, treasurer, Wyman-Gordon Co., Worcester, Mass.; H. V. Hale, general manager, Saginaw Sheet Metal Works; H. J. Linkert, treasurer, the Recording & Computing Machines Co.; C. L. Halladay, vice president and general manager, Jackson Motors Corp.; W. W. Sterling, vice president, Jackson Motors Corp.; C. L. V. Exselsen, vice president and treasurer, Roland A. Crandall & Co., bankers, Chicago; Guy Wilson, president, Traffic Motor Truck Corp.; Buell Hollister, Pyne, Kendall & Hollister, bankers, New York City; H. F. Holbrook, president, H. F. Holbrook, Inc.; M. Douglas Flattery, chairman of board of Murray-Tregurtha Corp.

Ohmer, who will have entire charge of the operations of the company, states that all the plants will be operated and that for the present the products of all of them will be continued. These include the Jackson, National and Dixie Flyer automobiles and traffic trucks. It was said also that trucks would be manufactured at the Kentucky Wagon and Jackson plants. Development of a standardized line of cars and trucks is the ultimate object of the company. This line is to include a four cylinder, a light six and a deluxe six-passenger car, and trucks of various capacities.

The companies in the merger have been acquired by purchase, payment being made in stock of the new corporation on the basis of actual inventory valuation of the various companies. Ohmer said that all companies taken in had to show assets having a ratio of three to one over liabilities. Although it was not divulged just what amount of capital stock was issued in absorbing the member companies, it is understood the combined net assets of the companies were listed at about $23,000,000.

Present plans include automobile assembly plants at Boston, Indianapolis, Louisville, St. Louis and Oakland, Cal. The company has no plant at Oakland, but is understood to be negotiating for one.

Plans include a subsidiary dealers' financing organization capitalized at $35,000,000. This plan will permit the dealer to sell cars and trucks on a small cash payment from which he will take his discount or commission and to accept for the balance notes which he will turn over to the finance corporation. Between 600 and 700 banks have agreed to buy these notes from the finance company, Ohmer said.

As to the parts manufacturers, Ohmer said the new corporation will use nearly the entire output of the various plants, but that any surplus would be disposed of at inside cost to other manufacturers.

Louis Ruthenburg, president, in general charge of production, resigned from General Motors to join Associated Motors Industries. He was manager of the Delco plant of General Motors and manager also of the manufacturing division of the General Motors Research Corp.

The company plans a production from July 1, 1922, to July 1, 1923, of 30,000 automobiles and 13,000 trucks. The passenger cars to be sold under the "National" name will embrace four-cylinder, light-six and deluxe six models. A complete line of "Traffic" trucks will be made, ranging from a "speed-boy" to a 3½-ton unit.

Associated Motor Industries, as it now stands, has assets of about $25,000,000, of which roughly half is fixed and half liquid. Against the $25,000,000 assets will be issued $6,000,000 10 year 7½ percent bonds, which have been underwritten and will shortly be offered to the public; $9,500,000 8 percent preferred and 187,000 shares of common.

Owners of constituent companies receive only stock in payment, and no company enters the combination unless net assets are three times liabilities. Application will be made to list the preferred on Chicago and New York stock exchanges. An early offering of $3,500,000 preferred is contemplated by Chicago banking houses.

A new record of 4,464 applications to drive motor vehicles was established in New York City during the last week of May. A new record for a single day was set with 1,044 license applications.

The Testing of Spark Plugs

BY HUGH G. BOUTELL*

THE importance of spark plugs is appreciated by every operator of a gasoline engine, whether he happens to be an aviator whose very life depends upon the correct functioning of the ignition system on his engine, the physician who trusts to his automobile to get him in the shortest possible time to the bedside of a sick patient, or the ordinary owner of a "flivver" out for a Sunday's pleasure drive.

The best construction for a spark plug is something about which there is a great deal of argument. No two manufacturers are in agreement on this subject, as is borne out by the great variety of plugs on the market, each of which seems to meet with a ready sale.

With the idea of testing the relative merits of all the different types, so as to be able to recommend, at least to government purchasers, the kind best adapted to their use, the Bureau of Standards of the Department of Commerce has developed a special series of tests for spark plugs and kindred appliances, such as magnetos and battery ignition systems. A view of the spark plug laboratory is given in Fig. 1.

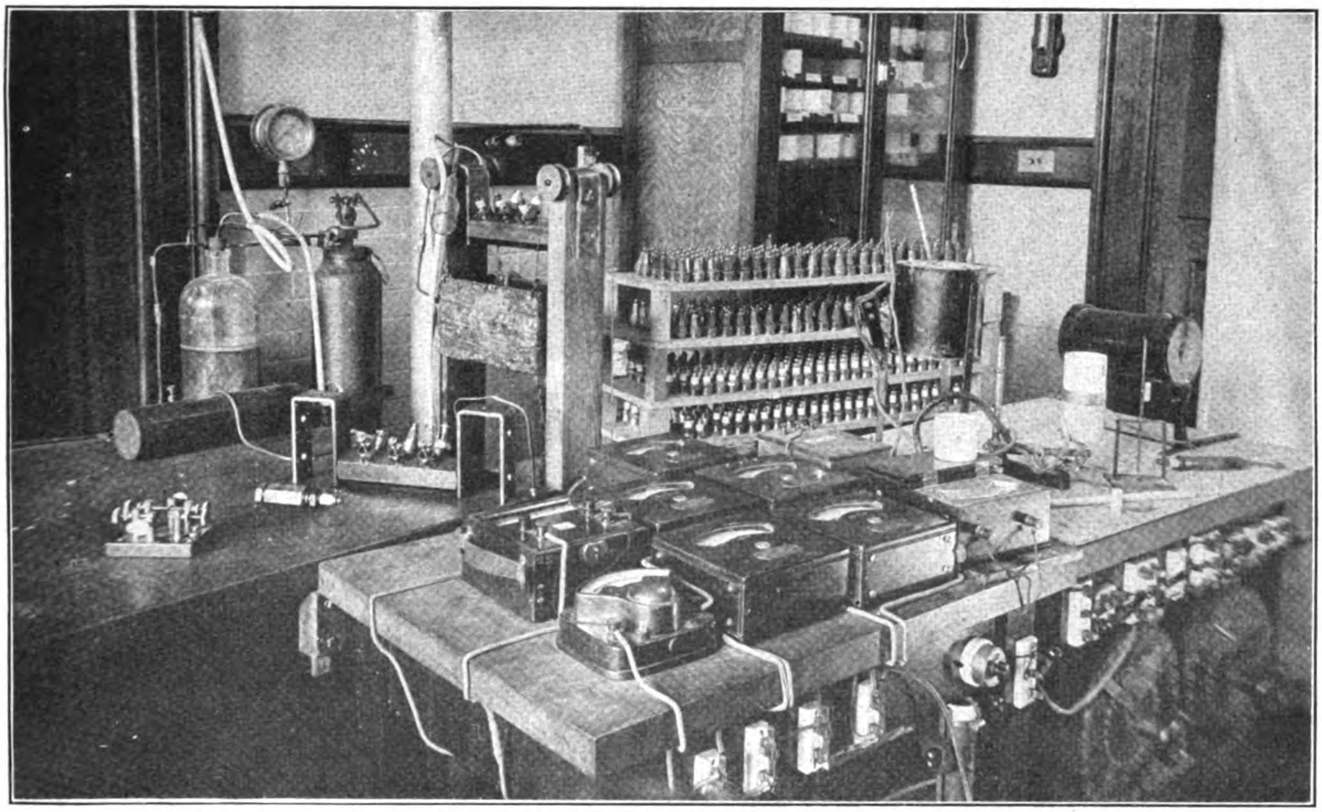


Fig. 1

A satisfactory test of an appliance ought to duplicate as closely as possible service conditions, though this end cannot always be attained. Fortunately, in the case of spark plugs, it is possible to test them both in the laboratory and when in service on an engine. Each laboratory test which the bureau has developed aims to bring out the weakness or strength of a spark plug along some particular line, while the service test on an engine indicates the general efficiency of the device as a whole.

Thus, there is a test to determine the value of the porcelain or mica in the plug as an insulator and its ability to withstand temperature changes, another test determines the amount of gas leakage through the plug, while a third test is used to estimate the resistance of the assembled plug to mechanical shock. Lastly, the actual heat of the spark produced at the electrodes is determined under definite conditions in a special calorimeter. The second test is a particularly important one for the reason that although the loss of power in an engine through gas leakage of the plug is very small, this leakage has a tendency to overheat the plug and hasten its failure.

The apparatus used for this test may be of interest. It consists, first, of a short hexagonal piece of steel bored out to form a tube and tapped at points along two of its sides for the reception of the spark plugs to be tested. One end of this pipe is closed, while the other is connected by a flexible piece of copper tubing to a compressed air reservoir. This piece of steel pipe or "bomb" into which the spark plugs are screwed is supported in a horizontal position by a wooden framework and is so arranged that a square metal tank containing oil heated by electricity may be placed so as to completely surround the tube, immersing the spark plugs for their entire length. Air pressure is admitted to the tube and if any leakage occurs at the spark plugs, it will bubble up through the oil. An inverted bell jar, the capacity of which is accurately

* Associate engineer, Bureau of Standards, Washington, D. C.

known, is placed over each plug and the time necessary to displace the oil in the bell jar with air is noted. The leakage of each plug in a given time under definite conditions of pressure and temperature can, therefore, be easily determined. This apparatus is shown in the general view of the laboratory, Fig. 1.

In making shock tests of assembled spark plugs, the machine illustrated in Fig. 2 is employed. The plug is screwed into a mechanically-operated hammer which is caused to strike against a piece of steel rail by a cam mounted on a shaft driven through a belt and pulley from a small motor. It has been found through experience that a good plug will withstand a certain number of repetitions of this shock test, while an unsatisfactory plug will fail in a much shorter time.

The engine or service test, which will always be the final test for any type of plug, is carried out on the kind of engine for which the particular spark plug is designed.

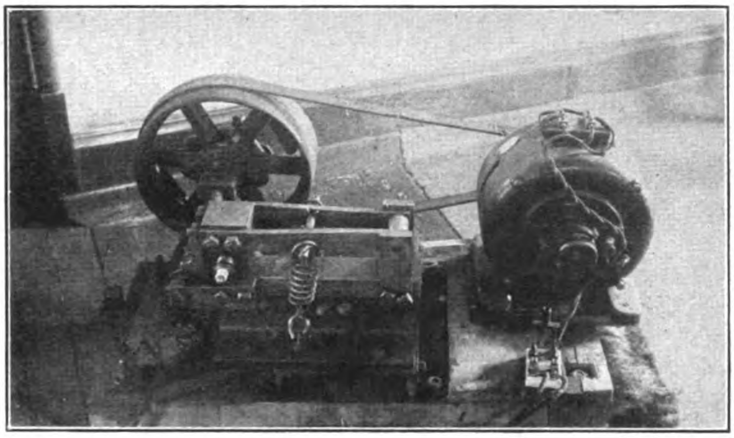


Fig. 2

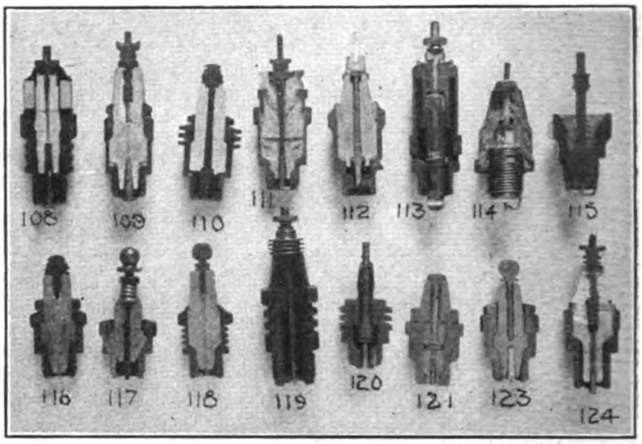


Fig. 3

Thus, one for an aviation engine would be tested in the altitude laboratory under actual conditions met with in flight, while the plug for service on automobiles or trucks would be given a trial run on typical motor car or truck engines.

Not the least interesting sight in the spark plug laboratory is the case in which are arranged for exhibition purposes plugs which have been sent to the bureau for test. The number runs into hundreds and there appears to be an almost endless variety of designs. Some of the plugs have been cut in two lengthwise, or "cross-sectioned," as shown in Fig. 3, so as to more clearly indicate their construction, and many are "fearfully and wonderfully made." As in every other mechanical device, simplicity and durability are prime requisites in a spark plug.

As a result of its extensive work on gas engine ignition, the bureau hopes, among other things, to be able to specify those qualities which a spark plug must possess in order to give satisfaction in service.

U. S. Leads World in Auto Exports

The United States leads the world in the export of motor cars and motor trucks. Forty percent of 1921 automobile exports came directly from factories in the U. S. A. Ten percent more were exported from U. S, branches in Canada, and the bulk of the 25 percent exports from France were re-exported U. S. war vehicles. Nine percent of this business was done by Italy, 7 percent by Germany, and 4 percent by England.

Production Men to Meet in Detroit

A national meeting of the Society of Automotive Engineers will be held in Detroit Oct. 26-27, for the purpose of discussing problems of automotive production. The meeting is to be known as the S. A. E. Automotive Production Meeting.

Papers treating current production problems in a simple and practical way will be read and fully discussed in morning meetings on each of the two days. The afternoons will be devoted to factory inspection trips especially arranged for the purpose of viewing new and advanced production methods that will particularly interest the tool, inspection and production men. The principal object of this meeting is the promotion of an interchange of experience between practical factory men on automotive production problems which are troubling them in their daily work.

An S. A. E. Production Dinner will be held Thursday evening, Oct. 26, where social friendships between production men will be promoted. Announcement of the locations of the meetings and dinner will be made in the near future. Special committees of Detroit S. A. E. members are in charge of the arrangements for this national meeting. K. L. Herrmann, a Studebaker production engineer, is chairman of the committee which is selecting the papers and topics for discussion. Suggestions or requests to present papers should be addressed to the S. A. E. New York office. Papers must be submitted before Aug. 15.

Cleveland Body Plants Busy

It is said that the number of employes in Cleveland body factories has increased more than 70 percent since the first of the year, the figures being based on a Cleveland Chamber of Commerce report. For the first time in many weeks, the Lang Body Co. is working full time. This company recently obtained a contract to build closed bodies for the Lincoln Motor Co., shipments to start September first. They have also a contract for Peerless closed bodies, which Edwards Mfg. Co., Cincinnati, O., have bought outright from the National Body Mfg. Co., of the same city. On May 1st the Edward Co. moved this plant to Norwood, O., just outside of Cincinnati, where it will be operated by the Edwards Mfg. Co., under its old (National) name and produce the well-known National body for Ford cars.

Provisions Required for Successful Use of Less Volatile Fuels

BY F. C. MOCK AND M. E. CHANDLER*

Average Operating Conditions of Today, and Modifications of Them Which Will Permit Use of Less Volatile Fuels—Methods of Heat Application

MANY 1922 model cars have operated satisfactorily with the motor fuels at present in use, both in summer and in winter, but many have not. We are convinced that it is possible to operate better a number of cars that are considered satisfactory today with kerosene, mixtures of gasoline and some heavier oils, combined with alcohol, benzol or other "anti-knock" components, than with gasoline. The sole requirement would be the proper preparation of the fuel in the manifold.

The requirements of proper fuel preparation are:

(1) A thoroughly and continuously homogeneous mixture of fuel and air with no drops or liquid film wall flow to the valve ports.

(2) The charge temperature should be the minimum possible while complying with requirement (1).

(3) The provision for a prompt change in the rate of action under changes of load and speed.

A cylinder charge of fuel is only a medium-sized drop. Any one who has observed through glass manifold sections, the storm of drops that is usually present, can easily appreciate the importance of this point. All the oil dilution in the crankcase is due, of course, to the introduction into the combustion-chamber of fuel that is not burned later. I believe that a large part of the rapid carbon formation, characteristic of engines having poor distribution, is due to the cracking, without burning, of the drops of excess fuel that occasionally enter the cylinders. It is evidently desirable to prevent liquid gasoline from reaching the cylinders after the use of a primer or choke means of starting.

If we consider as our objective a minimum temperature of the dry mixture, that is, a mixture of transparent fuel-vapor and air, it is immaterial, in theory, whether the heat is applied first to the fuel or to the air. If, however, we accept what our experiments have apparently demonstrated, that is, that a fog mixture of condensed vapor and air is satisfactory, provided the cylinder temperatures are such as to change this fog to a vapor before the end of the compression stroke, we shall find, both in theory and in practice, that the minimum temperature that can be used will vary with different methods of heat application. The theoretical considerations involved are, we hope, clearly shown by an analysis of the known and available methods of heat application. These have been classified as follows:

Case 1—The heat imparted to the mixture through the medium of the air, by the communication of heat from the manifold walls to the air and to such part of the fuel as has been deposited on the manifold walls. This is considered to involve only the production of a dry-vapor mixture. An interesting variation of this is shown as Case 1b, where part of the preheating of the air is accomplished by subtracting heat from the air and the vapor mixture already formed, thus giving a fog mixture.

Case 2—The application of heat first to the fuel alone, with the resulting condensation of the vapor when it joins the main air-column; this results in a fog mixture.

Case 2a—Heating the fuel and a part of the air to generate a rich dry-vapor mixture, which is then condensed as it enters the stream of the remaining air-supply. This also gives a fog mixture.

Case 3—Directing a spray of atomized fuel and air against a heated surface. One result obtained with this construction is the breaking up of the spray drops into even smaller drops in the socalled "spheroidal" condition; the mixture thus formed cannot be properly designed as a fog mixture.

This classification has been made on a functional rather than a structural basis. Most of the hot-spot constructions in actual use employ two, and sometimes three, of these heating methods, but for analysis the distinction we have made seemed necessary. Consideration of the direct application of heat to the fuel has been purposely limited to designs in which the fuel has been previously metered in a liquid state, as doing so after heating has not thus far been demonstrated as practicable.

In Case 1 the air charge receives a heat supply such that after the latent heat of evaporation has been supplied to the fuel, the resulting mixture will have the minimum temperature of a dry vapor. Its practical equivalent is the application of heat to the air charge before it enters the carbureter. With the complete evaporation of a 15 to 1 mixture of the high end point gasoline measured by Professor R. E. Wilson and, ignoring the heating of a small amount of fuel on the walls, this would involve air entering the carburetor at 154 deg. F., with a resulting mixture temperature of 135 deg. F. For the kerosene measured by Professor Wilson, the air would have to enter the carburetor at 287 deg. F., with a final mixture temperature of 230 deg. F.

In practice, however, dry mixtures are not realized at such low temperatures, for the reason that only part of the hot air comes into contact with the fuel. Within a short distance from the carburetor jet the tiny drops of fuel spray take up a velocity and direction identical with that of the air which bears them and thenceforth until they strike a wall, they generally are surrounded by a miniature atmosphere of vapor at the dew point. Fuel that travels along the walls comes into actual contact with only a thin film of air. We have endeavored by various means to create a turbulence that would accelerate and decelerate the spray droplets in the air medium that carries them, but every effort of this kind has resulted in increased deposition of fuel on the manifold wall and has made conditions worse than before. The temperatures actually existing in practice are more nearly those that would result if the fuel came into heat conducting contact with but one-half to one-third the air charge during the travel through the intake manifold. On such a basis the average temperature of the mixture is considerably higher, for instance, with a 15-to-1 dry mixture,

*Of engineering staff, Stromberg Motor Devices Co., condensed from a paper read at semi-annual meeting Society of Automotive Engineers.

and, as the fuel receives heat from one-half the air, the final average temperature will approximate 160 deg. F. with gasoline and 273 deg. F. with kerosene.

On account of the high heat capacity of dry mixture charges formed in this way, there being no cooling from any further evaporation of the fuel during the compression stroke, the tendency toward detonation should be, and apparently is, greater with this method of fuel preparation than with most others. Due to the relatively slow heat transfer, more than the customary difficulty is experienced during changes of engine speed and load. The proper functioning of a device of this kind is contingent upon the maintenance of adequate temperatures; but in actual practice such temperature regulation is distributed by a number of factors, depending upon seasonal and climatic conditoins, as will be explained later. Since the mixture-temperature depends upon that of the air entering the carburetor, which in most cars depends in turn upon the temperature of the cooling water and of the whole mass of metal under the hood, there is a long duration of "warming-up" which can be taken care of only by elaborate thermostatic devices. A factor of safety, to provide for the occasional use of fuels heavier than the average, can be obtained only by raising still farther the temperature of the fuel charge of normal operation. More important is the fact that there is nothing to prevent raw gasoline entering the cylinders during the starting and warming up period and probably also during normal running.

In Case 1b the fuel vapor is formed as in Case 1, but a smaller exhaust air-heater is used. The air entering the intake system, before it reaches the exhaust heater, is used to cool and condense to a fog the dry mixture coming from the carburetor. The temperatures of the air entering the carburetor and of the mixture leaving the carburetor are the same as in Case 1, but the final mixture-temperature in the intake manifold, if a complete heat-transfer could be established, would be considerably lower than in Case 1; for instance, 122 deg. F. with gasoline as against 160, and 188 deg. F. with kerosene as against 273.

In this method, the fuel, after being metered, is discharged into a heating chamber which the air charge does not enter; the vapor formed here is then mixed wtih the unheated air charge to form a true fog mixture. At first thought this system seems to be promising, but actually it has serious inherent disadvantages, for the reason that the delivery of vapor depends upon the temperature being kept above a certain minimum.

An open chamber will evaporate liquid below the boiling point much more quickly than a closed one, the difference being due solely to the more rapid escape of the vapor from the open chamber. The normal flow of vapor from the heating chamber should take place only when the vapor temperature is raised to the final boiling point of the fuel; that is, the vapor must be between 400 and 500 deg. F., which is much higher than the temperature needed with any other construction shown. The final temperature of the mixture may, however, be quite low because of the fact that very little more heat need be added to the system than is necessary to vaporize the fuel.

This arrangement might be hard to start and would possibly be slow on acceleration. With heavy fuels there would be a tendency for the heavy elements to collect in the bottom of the heating chamber during idling, when the exhaust temperature is lower than the boiling point of the fuel. Upon a sudden increase of the exhaust temperature this pool of heavy elements is apt to coke. In fact, we have known of a number of instances where a pocket for the collection and heating of the fuel would fill with greasy tar or coke. This trouble was marked particularly in high end-point gasolines.

This construction has the additional advantage, when properly designed, of permitting no liquid fuel to reach the valve ports. On this account, as also with Case 2a, it will give a homogeneous fuel charge, or "good distribution," as we call it, with any shape of intake manifold and any convenient location of the carburetor.

Case 2a is a sort of compromise between Cases 1, 2 and 3, which seems to possess all the advantages of Case 3 and fewer disadvantages. The mixture spray from the carburetor is thrown against a deflecting surface, that may be heated, and fuel not vaporized is thrown down into a heating chamber as in Case 2. An opportunity is afforded for the fuel to evaporate in and mingle with the air, before the separation of the liquid and the vaporized portion. This reduces the fuel lag on acceleration and also reduces the amount of fuel that must be taken into the heating chamber. An air circulation is maintained through the heating chamber, which helps to carry the vapor away as fast as it is formed; the action in the heating chamber then can be evaporation rather than boiling, as in Case No. 2. This distinction is important because boiling implies the maintenance of temperature above a certain point, at all engine speeds and at a constant pressure, while evaporation can take place at any temperature and, fortunately, under a change of engine speed, the decrease of the exhaust temperature being accompanied by a reduction of the fuel feed and the rate of evaporation.

The air taken through the heating chamber is, of course, highly heated, so that, as compared with Case 2, we have a small part of the fuel and of the air heated, to be cooled by the remainder of the air charge and a certain part of the fuel charge.

This arrangement possesses the advantage of Case 2, in allowing a large reserve capacity for warming up without excessive heating of the mixture under normal operation, and also of preventing liquid fuel from going into the engine cylinders. A device of this sort, though of entirely different design, has been used in the actual driving of a passenger car with a six-cylinder engine, and gave as good a demonstration on kerosene, with a benzol component to avoid detonation, and alcohol at a mixture-temperature of 120 to 140 deg. F., as with gasoline. It was also found possible to use heavier fuel combinations which resulted in considerably better operation than that shown by the average car in the hands of its owner. Starting on gasoline in very cold weather was not more difficult than with the ordinary carburetor and intake-manifold arrangement. In fact, no difficulty was ever experienced in starting; the starter was always strong enough to turn the engine over. Closing the choke would always effect a start. On gasoline the warming-up was very good. In weather 10 deg. F. above zero, it was necessary only to use the dash mixture control device for about ½ min. or less after starting, after which it was possible to set all the controls in the normal driving position and drive away. This usually synchronized with the development

of a mixture temperature of about 90 deg. F. With gasoline the fuel consumption was but slightly lower than with a good carburetor on a conventional type of hot-spot intake manifold, but the engine would run smoothly on very lean mixtures and the weekly mileage, particularly in winter, was better. The smoothnes and the absence of carbon, crankcase oil dilution and ignition trouble were marked. We found also improved operation at low speed on hills. The engine would pull smoothly and without apparent effort and maintain this smooth low speed pulling indefinitely.

This includes a condition aimed at, and more or less realized, in many hot spots in use today. It is the general belief, perhaps, that the fuel spray strikes the heated surface, vaporizes, and then condenses in the airstream. More recent observations lead us to believe that very little of the fuel vaporizes on the heated surface. It seems rather that the sudden application of heat to one side of the drops of spray, as they strike the heated surface, relieves the surface tension that holds them in globular form and causes them to burst; meanwhile, if an air draft is present, the "spheroidal condition" keeps them from adhering to the heated surface.

There is one interesting hypothesis of action under these conditions, the realization of which would give a fog mixture at very low temperatures that has a very simple structure. If the heating surface were of exactly the size and location to be wholly covered by the liquid of the fuel spray; if its heating capacity were such that it could vaporize all the fuel that strikes it; and if the scouring action of the air-draft across the heating surface were sufficient to carry away the vapor as fast as it was formed, it would be possible to produce the vapor at the relatively low temperature corresponding to a density of one-fifteenth to one-twelfth that of air; also, there should be little, if any, heat transmitted directly to the air from the heating surface. Under such conditions, which we believe can be realized only in theory, the mixture temperatures would be the minimum among all the systems suggested for producing a fog mixture by external application of heat energy.

The nature of such action, assuming complete evaporation at the surface is about as follows: There is, first, near the surface, a film of liquid, or a layer of liquid drops. Just off the liquid film the greatest vapor-density occurs, but as the distance increases and the air begins to lower the temperature, the molecules will begin to gather in small drops, in the action that we term condensation. It is obvious that it would be impossible to bring all the air into such contact with the liquid film that the vapor would be swept away, and uniformly diffused, within a few molecule paths of the liquid film, and it is only under such a condition that the former temperature balances could be obtained. But it also is clear that the more completely we can direct and diffuse the air charge on the heating surface in the conventional hot-spot design, the lower the temperature and density can be next the liquid film, the lower can be the temperature of the liquid film and the wall itself and the lower the final temperature of the charge.

Regardless of the correctness of the theory of operation of this type of hot spot, there are several advantages and disadvantages in practice that should be pointed out. As already outlined, reserve capacity can be obtained only by making the surface larger. Also, there is no inherent characteristic of this arrangement that would prevent liquid fuel from going into the engine. The heat capacity of the wall of any structure that could be used would be sufficient to prevent any lag in acceleration, provided the carburetor were made to give a charge of slightly increased richness with a fuel of graduated volatility.

In the quantitative computation of heat transfer, we first must take into account the very wire variations of temperature that the air charge and fuel supply undergo before they enter the intake manifold system. On account of the large range of variation of hood temperature, a rough indication of the various changes in temperature that a molecule of air undergoes in getting from the external atmosphere to the cylinder port, without purposeful application of heat to the intake charge, other than the commonly used hot air stove around the exhaust pipe is given. Starting from atmospheric temperature, the temperature of the air is raised between 30 and 60 deg. in passing through the radiator. The rise of temperature from the hot air stove is presumably about the same in the summer and in the winter but on many cars an appreciable portion of the heat added by the stove in the winter is lost before it gets to the carburetor, because of the cooling effect of the fanblast of relatively cold air on a long length of flexible tubing. The temperature drop in the carburetor and the manifold due to vaporization is indeterminate dependent upon the fuel, the temperature and the vacuum. In many cars the intake manifold is so close to the exhaust that under full load the temperature is raised considerably by the cross radiation. We have sometimes gained 3 to 4 h.p. in a maximum of about 70, by cutting off this radiation with asbestos board.

This will give an idea of the range of natural temperature-variation with which our intake systems have had to deal. Between the temperature of the air entering the intake system just after starting in the winter and that during a long run in the summer, there easily may be a difference of 120 deg. F. Very few current applications of heat to the intake charge, by either hot air or hot spots, affect the temperature one-half this amount. Any effort to attain minimum charge temperatures in actual practice must include means for dealing with the natural temperature variation under the hood.

With heating methods that approximate Case 1, the heating surface should perhaps be in two sections, one of which is in action at all times, and the other of which may be thrown open to the exhaust, either by a seasonally regulated valve, or by the dash mixture control of the carburetor.

Arrangements such as Case 1a can be controlled within certain limits of temperature by using a hot air stove on the exhaust line that has at least three times the heat capacity of those in common use today, with a valve adapted to cut off part of this hot air and admit cold air as the engine warms up. The regulation should preferably be automatic.

In the methods of Case 2, no particular regulation for variation of atmospheric temperature is necessary. The heating action is almost independent of the outside temperature. With this type of construction, I have always recommended making the heater large enough so that cool air from outside the hood will be taken into the carburetor in the summer time.

Case 3 would perhaps be taken care of best by a regulable variation in hot spot area. Difficulty is experienced

(Concluded on Page 29)

The Role of the Oven in Automotive Maaufacturing--II

How Modern Parts and Body Manufacturers Have Come to Lean Upon the Oven for Drying, Enameling, Japanning, Lacquering and Other Processes

CONTINUED FROM JUNE ISSUE

Schedules of Operation

The appended tables show the time required, temperature, humidity, etc., for drying the various coats given under the schedules used by manufacturers of car in different price classes.

Medium Priced Cars

For colors such as green, which will stand temperature from 160 deg. to 180 deg.

Prime and lead coat	1 day
Putty, first and second R. S.	1 day
Oil, sand, ground color	1 day
First and second color varnish	1 day
Water rub and trim	1 day
Finish	1 day

Low Priced Cars
(Fast Schedule)

Prime coat	3 hr.	3 hr.
Lead	2 hr.	2 hr.
First and second R. S. ....each	1½ hr.	3 hr.
First and second color varnish.each	1½ hr.	3 hr.
Finish	6 hr.	6 hr.

Total time from prime to finish, including trim, 3½ days.

On all of these fast schedules the drying is accomplished by means of air washing and humidifying equipment in which is employed a very large volume of air, as otherwise if it is attempted to do it with an equipment in which there is only the normal rate of air change, the coating will surface harden.

The relative humidity at temperatures of 160 deg. to 200 deg. runs in the neighborhood of 22 percent to 30 percent, whereas from 160 deg. to 120 deg. it runs from 30 percent to 45 percent, but the actual amount of moisture in the air for these higher temperatures is very great, otherwise the surface would case harden almost immediately by coming in contact with the large volume of extremely warm air.

Drying Schedule of High Grade Car

Prime		Sealer coat,	
Lead	1 day	color coat	1 day
Putty glaze,		Egg shell,	
First R. S.	1 day	First C. V.,	
Second R. S.,		Second C. V.	2 days
Third R. S.	1day	Rub,	
Fourth R. S.,		Third C. V.,	
Fifth R. S.	1 day	Rub	2 days
Rub out,		Black off,	
Ground coat	1 day	Finish	1 day

This is an 11-day schedule without including time for trimming. The temperature, humidity, and drying time are as follows:

	Temperature, Degrees	Humidity, Percent	Drying Time
Prime	120-130	30-35	4-6 hr.
Lead	120-130	30-35	4-6 hr.
Putty glaze	120-130	30-35	3-6 hr.
First R. S.	120-130	30-35	3-5 hr.
Second R. S.	120-130	30-35	3-5 hr.
Third R. S.	120-130	30-35	3-5 hr.
Fourth R. S.	120-130	30-35	3-5 hr.
Fifth R. S.	120-130	30-35	3-5 hr.
Ground coat	125-130	30-35	2-4 hr.
Sealer coat	125-130	30-35	3-5 hr.
Color coat	125-130	30-35	2-4 hr.
Egg shell	125-130	30-35	3-5 hr.
First C. V.	120	37-42	4-6 hr.
Second C. V.	120	37-42	4-6 hr.
Third C. V.	120	37-42	4-6 hr.
Bl'k off and stripe	110	40-45	2-4 hr.
Finish varnish	100-104	45-50	10 hr. or overnight

Schedule for Very High Grade Work

	Temperature, Degrees	Humidity, Percent	Drying Time
Prime	120-125	30-35	8 hr.
Half and half	120-125	30-35	8 hr.
Putty coat	120-125	30-35	4-5 hr.
First R. S.	115-120	35-40	4-5 hr.
Second R. S.	115-120	35-40	4-5 hr.
Third R. S.	115-120	35-40	4-5 hr.
Fourth R. S.	115-120	35-40	4-5 hr.
Preparation coat	115-115	35-40	3-4 hr.
Color coat	110-115	35-40	3-4 hr.
First C. V.	100-105	40-45	8 hr.
Second C. V.	100-105	40-45	8 hr.
Third C. V.	100-105	40-45	8 hr.
Finish varnish	90- 90	45-50	24 hr.

There is a rubbing operation between the second and third color varnish coats and also after the third color varnish coat.

Details of Construction

The Maehler ovens have been referred to and illustrated, and it is but fair to consider their construction. They are built in sectional forms, all side wall, roof and floors being made in 12, 18, 24, 30 and 36-in. widths, while the corner units are made 12 in. each way from the bend. This facilitates rapid assembling, or setting up with a minimum of labor and other costs, and makes it possible to enlarge or move the oven when this is desirable or necessary, at equally low cost. Inside walls are constructed of 22-guage or heavier black sheet steel, and outside walls of 22-gage galvanized. All braces, straps and other parts are standard structural sizes.

Particular attention has been paid to heat insulation, because operation by gas or electricity is general and both these are high in price so it is important to conserve them as much as possible. The material to be used, and its thickness are determined by the temperature to be maintained. Sol-O-Cel, Non-Pareil or Asbest-O-Cel are used between inside and outside walls of roofs, side walls and floors, in thicknesses varying from 2½ to 4 in. The first two are used for high temperature work, the last-named for low temperatures.

Ventilation and Circulation

Next to insulation probably the most important factor towards successful operation of industrial ovens is ventilation and circulation of air within the oven. Proper drying or baking can only be done in circulating air. Vents must be provided not only for the intake of fresh air but for the escape of fumes and vapors created during the drying process, and the products of combustion where gas or combustible fuel is used as the source of heat. The perfect ventilation obtained in Maehler Ovens is the result of

exhaustive study of heat radiation, air currents, the elimination of dead air pockets and changes of air necessary within the oven under varying conditions. It embodies some radical departures from former methods.

This ventilating system on which patents are pending, combines the principles of natural air circulation during the period of pre-heating with forced circulation during the period of activity when the air is employed as a drying or baking agent, and a combination of natural and forced ventilation so connected as to produce a siphoning action of elimination controlled at all stages of the baking process.

Natural ventilation is secured by the installation of vents in the roof of the oven connected to a natural draft stack.

Forced Ventilation

Forced ventilation is secured through the use of an American Blower Co.'s "Sirroco" selective type exhaust fan, connected to ducts opening near the floor of the oven. The fan is mounted on a unit bed plate, directly connected to a Westinghouse or G. E. motor, by a flexible coupling and wired to a switch conveniently located on the front of the oven. The use of a flexible coupling to connect fan and motor is a decided improvement over belt drives in that it eliminates belt slippage and insures positive, uniform performance.

The exhaust fan outlet projects into the natural draft stack at a point above the oven, and when the fan is running sets up an induced draft or siphon action with an air movement equal to that ordinarily secured from a much larger fan. In consequence, a motor of lower rating, usually not larger than ½ h. p. is installed, consuming a corresponding decreased amount of current to secure desired results.

Ventilation Control

The heavy fumes created in the early stages of baking operations must be eliminated quickly and the practice heretofore has been to install a fan of such capacity as to secure this rapid elimination. However, owing to lack of control the same ventilating speed was necessarily maintained throughout the bake, producing an excess removal of air.

In the system, ventilation is controlled through the use of dampers installed in the natural draft stack. As the baking operation proceeds and fumes become lighter, these dampers can be regulated or closed and ventilation secured entirely through action of the fan pulling air from the bottom of the oven.

Fuel for Industrial Ovens

Practically every type and kind of fuel can be, and has been used in ovens of this kind, including coal and coke, oil, steam, gas and electricity. This firm favors the two latter because of the ease and accuracy with which the oven temperatures can be controlled when they are used, and also because of their flexibility to meet all shop operating conditions.

Gas and electricity are today the most efficient fuels for heating industrial ovens, and in many cases one or the other is absolutely necessary. Gas was the first satisfactory fuel available, both from the standpoint of high efficiency and heat control.

In present day enameling and lacquering processes, cleanliness and fine finish are essential. Colors such as gray, green, red, olive green, white and yellow are used extensively on many wood and metal products, and it is in the drying of these and even more delicate shades that gas has proved most valuable, especially as it is applied in ovens of the indirect gas heated type.

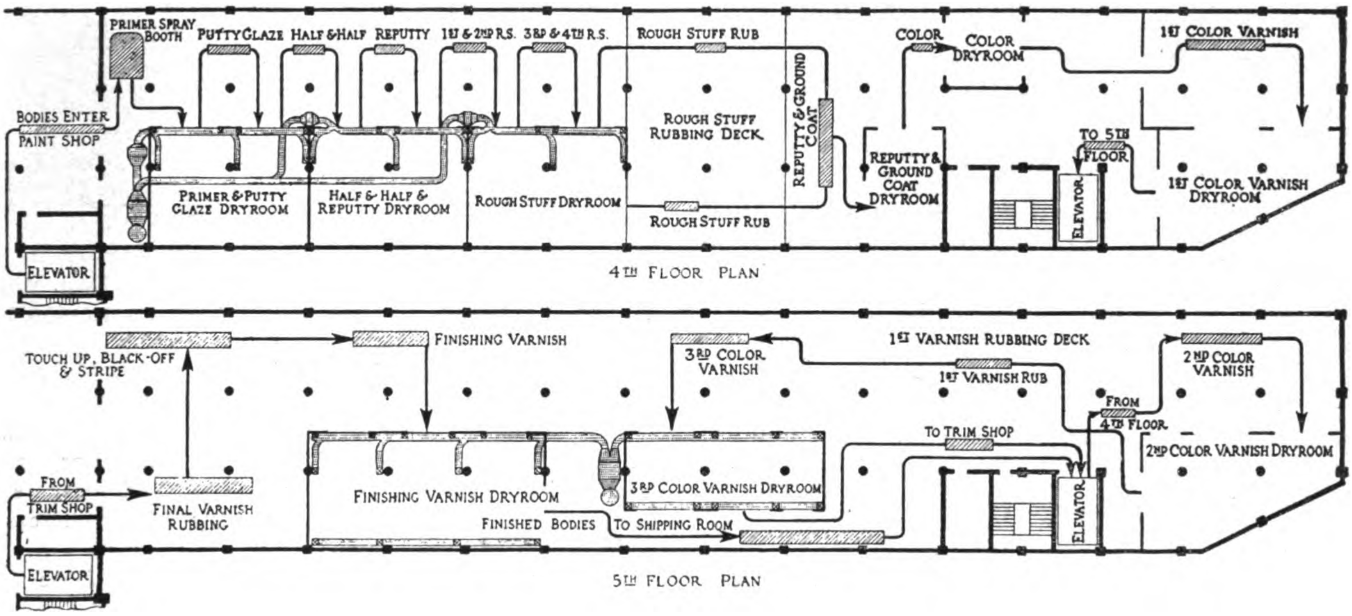


Fig. 13. Suggested layout for a progressive system of painting and trimming in a modern automotive paint shop.

In all cases where gas can be used as a fuel in the drying of japan finishes, the indirect principle of gas heating has numerous advantages, but the securing of desired heat and maintenance of uniform temperatures with minimum fuel consumption depends on the employment of proper heating units.

Radiators and Burners

To meet these conditions the type "B" radiator or heater shown in the accompanying illustration has been designed. It is so constructed as to secure complete combustion of the fuel, offering simplicity in gas control and efficiency in heat distribution. Gas combustion is entirely confined, the products of combustion being circulated by inducted draft from the burner chambers in a slow, devious travel through the numerous horizontal tubes to the radiator vent in the center.

This radiator utilizes every possible unit of heat energy. The use of horizontal tubes, coupled with the inclusion of baffles and greatly diminished openings at points where

the combustion gases enter the vents, creates a high resistance to the free passage of these gases, and this, with the large surface area of the entire radiator, results in high heating efficiency and uniformly developed radiation.

Heaters are usually located on each side of the oven, with their individual outlets or ventilating ducts. Insurance underwriters generally recommend the radiator or indirect heating type because of its safety in the presence of combustible vapors.

On large radiators a flange connection is made between heads and burner chamber. The heads are set on asbestos gaskets and drawn tight by four slotted brass pin and spline connections. The splines are easily released and the entire tubular section can be readily removed from the burner chamber for cleaning of walls or tubes.

Both atmospheric and pressure burners are employed, the former in small and low temperature ovens and the latter in large and high temperature ovens.

Pressure burners are of an original, patented design, a thorough mixing, injector effect being obtained through the use of a finely machined, diverging nozzle and mixer, and complete combustion is secured through the use of blast tips spaced closely together.

These burners will turn down eight to one without backfire. They create no noise, are extremely flexible, and use no forced air as air supply is induced by the injector and nozzle. Roots gas pumps are used to boost gas pressure by coupling or gear drive. Uniform pressure is obtained by coupling a regulator in the burner line and accurate, uniform temperature is assured through the use of Robertshaw or Bristol automatic regulators.

The efficiency developed in indirect gas heating has made direct heating of industrial ovens practically obsolete, it being principally employed in annealing ovens where high temperatures are desired and some in foundry ovens.

With direct or exposed flame burners the products of combustion are discharged directly into the oven, mixing with the air and gases therein and escaping through the regular ventilating ducts.

The following well-known automotive firms, and manufacturers of automotive parts may be mentioned as representative users of these ovens: Durant Motors Co., of Michican; Studebaker Corp., Packard Motor Car Co., Jonas Cadillac Co., Packard-Omaha Co., Remy Division of General Motors Corp., Reynolds Spring Co., Forbes Varnish Co., Ternstedt Mfg. Co., Shelby Steel Co., Corcoran Pressed Metal Co., Biflex Bumper Co., Ramspring Bumper Co., Automotive Parts Co., Adams & Westlake Co., Howe Lamp Co., Rose Tire Pump Co., Kentucky Tire Pump Co., Longdin-Brugger Co., Champion Ignition Co., Stromberg Motor Devices Co., Interlocked Cushion Seat Co., and others.

Auto Body Builders Assn.'s Summer Meeting

The Automobile Body Builders Association held its summer meeting at the Hotel Statler, Detroit, June 20-21, with a good attendance. At the first day's session President John Graham addressed the members, after which a paper by H. H. Babcock (H. H. Babcock Co.) was read on "Discrimination in Freight Rates Against Automobile Bodies." "Preparing Automobile Bodies for Paint," was the title of a paper by W. C. Du Comb, jr. (American Chemical Paint Co.). L. Valentine Pulsifer (Valentine & Co.) presented an address on "Automobile Varnishes and Paints," while Armin Elmendorf (Haskelite Mfg. Co.) treated of "Plywood Body Construction."

E. J. Thompson (E. J. Thompson Co.) delivered the opening address, being followed by John W. McClure, of the National Hardware Lumber Association, who spoke on "Inter-Association Contracts." The "Report of the Service Committee" was presented by that committee's chairman, Francis D. Willoughby (Willoughby Co.). "Service Committees" was the subject of Henry R. Cobleigh, secretary service committee of the National Automobile Chamber of Commerce.

At Wednesday's meeting James Morrison (Highland Body Mfg. Co.) read a paper on "The Standardization of Seats," followed by Will H. Ritter (English & Messick Co.) on "The Standardization of Door Latches." C. F. Barndt then presented the report of the standardization committee.

Officers of the association are:

President, John Graham, the Holbrook Co., Hudson, N. Y.

First Vice President, H. H. Babcock, H. H. Babcock Co., Watertown, N. Y.

Second Vice President, H. C. Urich, Fleetwood Metal Body Co., Fleetwood, Pa.

Third Vice President, H. H. Seaman, Seaman Body Corp., Milwaukee, Wis.

Secretary-Treasurer, F. D. Mitchell, 1819 Broadway, New York.

Meeting of Associate Members

On the first day, a meeting of the associate members was called to order by J. R. Fitzpatrick, chairman, who urged that the associate members give more attention to the campaign for a larger membership; that associates would only reap the full benefit of their membership when every available prospect had been brought into the association; not only should all suppliers be induced to join, but likewise every body builder—in fact, the latter were the more important to the supply members and special effort should be undertaken by the associates to increase the body-builder membership.

A. M. Merrill suggested that the executives of the associate member firms should inform their travelers of the airs, membership requirements, dues and other plans of the membership campaign, and present these matters to non-member body builders when calling upon them.

H. A. Sanger suggested that trade journals publish a list of the new members and other association news from month to month.

Mr. Singer offered a motion, which was carried, that the matter of adopting a symbol or insignia for association members be studied. He was appointed chairman of this committee and will report the results to the January meeting.

Chairman Fitzpatrick urged that the members begin now to think about next year's body builders' show. Last year's show was an excellent start; the attendance was of 100 percent "prospects," and as the associate members got the greater benefit; they should work now to make the show a representative one and reserve their space early.

It was finally decided to appoint a special membership committee that would confine its efforts exclusively to body builders. Mr. Merrill was made chairman of this committee.

Provisions Required for Less Volatile Fuels

(Concluded from Page 25)

in practice in confining the heat to the region where it is desired. In warm weather the heat from the warm hood atmosphere tends to conduct across the flange junctions and through the walls of the heating chamber.

As has been brought out in the foregoing, a homogeneous mixture requires a fine spray from the carburetor issuing directly into the heating region. If the fuel is allowed to condense or gather on the walls, it will reach the hot surface in waves and irregularly timed splashes, under which conditions the carburetor setting must always be somewhat rich, and many details of engine operation will suffer. Acceleration is always more difficult when there is a fuel lag between the carburetor and the heating surface.

The arrangement, common in many heavy duty engines, of locating the governor between the carburetor and the hot spot, is very bad. Everything indicates that the carbon deposit will be reduced to the minimum and crankcase oil dilution eliminated only when this custom is discarded and the carburetor is placed close to the hot-spot.

Several 1922 engines that have the property of operating very smoothly on extremely lean mixtures, have intake manifolds that are characterized by a hot-spot at the carburetor opening and have additional contact with the exhaust manifold a little farther along, usually at a point of division of the fore-and-aft reaches. Apparently the second "spot' 'catches some of the particles that elude the first one and gives a more complete and steady evaporation.

One important requirement of a successful fuel charge heater is that it should warm up and get underway quickly. The walls should be thin, and, if cast, should be lightly ribbed on the exhaust side. Aluminum combines low specific heat and rapid conduction and is a very suitable material for a cast hot spot heating surface, if there are no shielded parts that get so hot that they melt.

It is recognized generally that it is desirable to prevent liquid fuel from reaching the cylinder and it has been claimed for many designs that they have this action. We have tried models of a number of them and have found that few impede the travel of liquid fuel to the cylinders in even a slight degree. With transversely ribbed elbows, for instance, the fuel drops are caught off the tips of the ribs by the air eddies and snatched through the elbow as if no ribs were present. This, of course, is with air velocities above 70 ft. per second, and part of the lively action naturally is due to the spheroidal condition already described.

We have used centrifugal force, surface tension and the force of gravity to separate the unvaporized drops. Careful combination of all seems to be required to achieve complete separation. A partial separation, which should be very effective at low engine speeds, can be obtained by abruptly increasing the manifold area above and beyond the hot spot. This would allow the heavy drops to settle down and again be hurled against the heating surface. The separation and recirculation would obviously be beneficial to the action of either Case 2 or 2a, but the heat supply must be adequate or the fuel will not reach the engine, with an actually functioning liquid fuel separating device.

After watching the fuel, in an accumulation equal to many cylinder charges, bubbling, splashing, sometimes lying quiescent on the heating surface of glass-walled hot-spots, and sometimes swept through in a high-velocity spray, one fact stands out: the rate of fuel-feed from the manifold to the cylinder primarily governs the conditions of combustion, and the rate of fuel-feed to the manifold is an indirect rather than a direct controlling factor, as regards the mixture proportion of the charge actually used by the engine.

Manufacturing Automobile Body Panels

Continued from Page 10)

In conclusion, the writer would like to call attention to the warning voiced by those with a varied press experience; that is, when buying a power press, especially if it is to be used for drawing operations, select one with reserve power above the actual requirements. A double-crank toggle drawing press with a 10-inch crankshaft is more economical in the long run for doing the work that a 9-inch crankshaft machine is normally intended for, than a press of the latter size would be. The reserve power of the 10-inch press will give an additional factor of safety and avoid mishaps and breakdowns. A press is subjected to unusual stresses, and the larger machine having an excess of strength, will not be injured by the overload and consequently will always be ready for continuous production.

June Output New Production Record

Shipping reports to the National Automobile Chamber of Commerce, 90% complete, indicate that June shipments will reach a total of 33,000 carloads, 30,500 driveways, and 7,900 boat.

On this basis it is estimated that 271,022 passenger cars and trucks were produced by all makers in June, an increase of 6% over May and 51% over June, 1921. Last year June production increased 9% over May.

The factory shipping figures for all manufacturers are:

	Carloads		Driveaways		Boat	
	1922	1921	1922	1921	1922	1921
January	15,357	6,485	7,479	3,185	143	93
February	19,636	9,986	10,173	7,507	180	99
March	27,753	16,287	16,917	9,939	560	75
April	31,334	20,187	22,381	14,197	2,960	1,619
May	34,324	18,608	28,760	15,193	7,366	2,381
June	*33,000	20,269	*30,500	18,834	*7,900	3,947

* Partly estimated.

Auto Shows Open Jan. 6 at N. Y., and Jan. 27 at Chicago

Dates for the two National Automobile Shows have been decided upon by the National Automobile Chamber of Commerce as follows:

New York, Jan. 6-13, at Grand Central Palace.

Chicago, Jan. 27, Feb. 3, at the Coliseum and the First Regiment Armory.

Burdick Looks for Body Plant in East

John S. Burdick has resigned as vice president and general manager of the Buffalo Body Corporation, Buffalo, N. Y., and is investigating the possibilities of establishing a body plant at some point in the east for the manufacture of fine motor coach work in limited quantities. His present address is Hamburg, N. Y.

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

A. Ward LaFrance, former president of the Ward LaFrance Truck Corp., will be associated with R. W. Walker, president of the Walker Motors, Inc., in charge of production of the Walker-LaFrance trucks. The LaFrance plant at Elmira, N. Y., was purchased by Walker. The plant will be moved to New York City, where the Walker properties are, and the LaFrance trucks will continue to be manufactured, but particularly for the New York market. The product will be known as the Walker-LaFrance.

J. G. Weiss has retired from active duties as general manager of the Hyatt Bearings Division of the General Motors Corp. on account of his health, but remains in the Hyatt company in an advisory capacity. H. J. Forsythe, formerly assistant general manager of the division, has been appointed general manager. B. G. Koether, in addition to his duties as vice president in charge of sales, becomes assistant general manager.

W. D. Kelly, for several years works manager of the Oakland Motor Car Co.'s plant, and G. Roy Williams, formerly with Oakland and recently a member of the Nash Michigan distributing company in Detroit, have organized the Kelly-Williams Co. to conduct a service garage, accessory shop and handle Willys-Knight, Overland and Nash cars in Pontiac, Mich.

E. T. Causer, general superintendent in charge of automobile manufacturing of the Nordyke & Marmon Co., resigned, effective July 1. Causer is well known in the manufacturing field, being identified formerly with the Mitchell Automobile Co., the Westinghouse Co. and the Driggs Seabury Ordnance Corp. He has made no announcement of his future plans.

R. J. Goldie, for six years manager of the Columbia Axle Co., has been appointed general manager of the Ruggles Motor Truck Co. Frank W. Ruggles, who has been functioning as general manager since the foundation of the company, will remain as president, but will devote himself to the wider interests of the business.

Edward Welchans, formerly engineer for the American Bosch Magneto Corp., has become chief engineer for the J. & B. Manufacturing Co., Pittsfield, Mass. He will have charge of engineering in connection with ignition products of that company.

Alfred P. Sloan, jr., accompanied by Mrs. Sloan, sailed for Europe on July 4 to visit England, France and Switzerland. While Sloan's trip is in the nature of a vacation, he will visit the General Motors Corp. offices in London and Paris.

P. H. Falter has been elected vice president and treasurer of the Electric Furnace Construction Co. Until recently he has been vice president and general manager of the Canadian Electro Products Co. at Shawinigan Falls, Quebec.

Harry G. Stoddard, vice president and general manager Wyman-Gordon Co., Worcester, Mass., has been made a director of the Associated Motor Industries, a new consolidation of producers of automobile trucks and parts.

Floyd H. Smith, formerly associated with the Pierce-Arrow Motor Car Co., Buffalo, as director of purchases, became identified with the Simms Magneto Co., East Orange, N. J., on July 1, as assistant general manager.

Emmett Paige, who was plant superintendent for the Oakland Motor Car Co., is now associated with the Jig Bushing Co., Pontiac, as one of the owners, though not taking an active part in its operation at present.

James McAvoy has been made director of the patent section of the advisory staff of the General Motors Corp., with offices in Detroit. McAvoy has been in charge of the legal department at Detroit.

George Fritz, who has been general manager of the Research Club, Chicago, for a year and a half, has resigned, his action to take effect Aug. 1. He has not announced his future plans.

Clifton Reeves, industrial engineer of the Willys-Overland Co., has been named chairman of the Toledo section of the American Society of Mechanical Engineers.

A. B. Acker of the Packard Motor Car Co. of New York has been elected president of the Purchasing Agents Association of New York, which counts among its members the purchasing agents of 400 leading companies.

J. Slocum O'Rourke, recently purchasing agent for the Oakland Motor Car Co., is now a member of the Steelcraft Co. of Detroit, manufacturing steel furniture.

William Beckman has severed connections with the Richelieu Motor Car Co. and the Richelieu Motor Corp. His plans for the future are indefinite.

Louis Ruthenburg has resigned from the General Motors organization and will retire July 1 as superintendent of the Dayton Engineering Laboratories Co.

John N. Willys sailed for Europe on July 8, where he will review foreign business conditions and also take a well-earned rest of a few weeks.

Frank Drouillard, formerly assistant superintendent of Maxwell in Detroit, is now a Maxwell dealer in the Pontiac territory.

H. Collier Smith, president Quickwork Co., St. Marys, O., sailed June 20 for an extended visit to Europe.

Body Builders

Fisher Body Corp., General Motors building, Detroit, is perfecting plans for the erection of additional units to the new plant now in course of erection at Junction avenue and the Michigan Central railroad, to be occupied by its subsidiary organization, the Shepard Art Metal Co., with present plant at Grand boulevard and Hastings street. The first unit will have a total area of about 100,000 sq. ft., all of which will be given over to the manufacture of hardware specialties, locks, etc., for automobile body construction. Later units will increase the floor space to about 250,000 sq. ft. The Fisher company has acquired the plant and business of O. J. Beaudett & Co., Pontiac, Mich., manufacturers of automobile bodies, and will continue the works as one of its divisions. The Pontiac plant approximates 300,000 sq. ft. of floor space, and will give employment to about 1,500.

Barton Auto Top Co., 4445 Woodward avenue, Detroit, has awarded a contract to W. M. Pratt, Penobscot building, for a new three-story plant, 62 x 160 ft., on West Canfield avenue, estimated to cost about $50,000, including equipment. Albert Barton is president.

Hodes-Zink Co., Fremont, O., makers of automobile accessories, has leased a building at 10th and Parade streets, Erie, Pa., for a branch factory. It manufactures automobile tops and other accessories. A. E. Blenner will be manager of the Erie plant.

H. R. Chupurdy, 221 W. 53rd street, New York, manufacturer of automobile tops and equipment, has organized the Chupurdy Auto Coach Works, Inc., to manufacture

(Continued on Page 32)

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Ford Motor Co. of Canada, Ltd., announces that it will soon begin the erection of a large motor car plant immediately adjacent to the works at Ford City, Ont. It will cover 125 acres and cost about $6,000,000. The new plant is to turn out 500 cars a day. The entire capacity will allow a production of 1,000 cars per day. The new property extends for 2,000 ft. along the river front. The buildings will all be one story, with daylight roofs. The present plant will gradually cease to operate as a motor car factory, following the completion of the new buildings, and will eventually be devoted to the manufacture of car bodies, a line of manufacture not now carried on by the Ford company here.

Penn Motors Corp., 1714 North Broad street, Philadelphia, manufacturer of motor trucks and parts, has been consolidated with the Belmont Motor Co., Lewistown, Pa. The production of the combined company will be increased to include motor-driven cultivators and parts for agricultural service, metal sash, etc. The Penn company previously operated a plant at Riverton, N. J., and which was destroyed by fire about a year ago. Hilton W. Soffeld, president of the last noted organization, will be prominent in the new company.

Hartford Auto Parts Corp., Hartford, Conn., recently incorporated with a capital stock of $430,000 to take over the defunct Hartford Automotive Parts Co., organized by the election of the following officers: President, Charles A. Dana, head of the Spicer Mfg. Corp., South Plainfield, N. J.; vice president, John S. Berry; secretary-treasurer, Paul D. Hawkins, all of Plainfield. The directors include Charles A. Dana, Lenore Carbaugh, Colonia, N. J., and Ezra P. Prentice, New York.

Bain Wagon Co., Kenosha, Wis., control has been acquired by W. L. Dixon and J. F. Griswold, Los Angeles, Cal., for 16 years Pacific Coast distributors, from George A Yule, and on July 1 assumed the general management of the works and business. Mr. Yule is retained in the capacity of president for the present. The Bain Wagon Co. is one of the oldest and largest manufacturers of horse-drawn vehicles in the United States, having been established in 1840.

Ford Motor Co., Highland Park, Mich., has awarded contract to the Austin Co., 208 South La Salle street, Chicago, for a one-story addition, 80 x 260 ft., estimated to cost approximately $50,000. The company is reported to be planning the erection of works in the vicinity of Minneapolis for automobile and tractor production. It will include a hydroelectric generating plant and is estimated to cost in excess of $1,500,000. A site is being selected.

Arrow Motor Co., Sandusky, O., recently incorporated to take over the Maibohm automobile plant in that city, has been organized by the election of A. C. Burch, president; Oliver P. Brace, vice president; Joseph G. Pyle, secretary, and E. E. Ernst, treasurer. The board of directors includes the officers and R. E. Hayslett, treasurer Hydraulic Steel Co., Cleveland; E. G. Kirby and Stanley G. Hiatt, Toledo, and M. T. Brotherton, Detroit.

Ford Motor Co., Highland Park, Mich., has awarded contract to the Fred T. Ley Co., Springfield, Mass., for two buildings, each one-story, 110 x 120 ft., at its new plant at Green Island, N. Y., used for the manufacture of ball and roller bearings, automobile and tractor parts, etc. A store house and concrete dock will also be constructed at this time, and other factory structures later. Albert Kahn, 1000 Marquette building, Detroit, is architect.

Y. F. Stewart Motor Car Mfg. Co., with plants at Bowling Green, O., and Louisville, Ky., has taken over the former plant of the Immel Body Co., Columbus, O., and will manufacture a low priced steam car to be known as the Coats steamer. It is expected that within a month the production of cars will number 10 a day. Y. F. Stewart is president and G. A. Coats vice president and general manager.

Studebaker Corp., South Bend, Ind., has laid foundations for five new buildings, comprising a four-story structure, 100 x 600 ft.; a one-story shop, 50 x 96 ft.; a two-story shop, 72 x 156 ft.; one-story car loading and car storage building, and a one-story power house addition, 50 x 50 ft. The extensions will cost in excess of $500,000. Albert Kahn, 1000 Marquette building, Detroit, is architect.

Biflex Products Co., North Chicago, Ill., manufacturer of automobile bumpers, has taken title to property adjoining its plant, consisting of a foundry building and land for further expansion. The addition will be used at once for the manufacture of double-barbumpers and it is expected to increase the output more than 100 percent. The plant area now approximates 5 acres.

Motor Wheel Corp., 701 E. Saginaw street, Lansing, Mich., has awarded contract to the H. G. Christman Co., Lansing, for two additions, each one-story, 120 x 400 ft., and 120 x 240 ft., respectively. The larger structure will be used for the manufacture of wire wheels, etc., and the other building for gear production. M. E. Harper is president and general manager.

Parenti Motors Corp. plant and property at Buffalo, is being purchased by the Hanover Mfg. Co., from the Marine Trust Co., trustee, for about $225,000. The new owner will take immediate possession and will install machinery for the manufacture of a small automobile, two-cylinder, air-cooled motor, designed to take the place of motorcycles.

Zenite Metal Co., Indianapolis, manufacturer of automobile parts, will add a one-story building, 100 x 200 ft., to its plant at 201 North West street. Herbert R. Duckwall is president of the company, which was organized in 1908 with $1,000,000 capital stock. Over 500 men are employed, but there is demand for an increased output.

Wilson Foundry & Machine Co., Pontiac, Mich., a subsidiary of the Willys-Overland Co., Toledo, O., is arranging for immediate increase in the manufacture of Willys-Knight motors. A portion of the No. 3 plant of the company will be used for this purpose, and it is proposed to double, approximately, the present output.

Standard Spring & Axle Co., Dallas, Tex., has purchased the plant of the Carlton Auto Spring Co., 2814 Main street, and will operate at this location; production to include the manufacture of steel springs of all kinds, as well as automobile parts. L. K. Weaver and Thomas P. Steger head the company.

Hercules Corp., Evansville, Ind., has discontinued the manufacture of automobiles and parts, and subsidiaries of the company devoted to this line have been dissolved, including the Hercules Tractor Co., Hercules Body Mfg. Co., Hercules Wheel Co., Hercules Buggy Co. and the Hercules Engine Co.

Doble Steam Motors Co., Call building, San Francisco, has acquired property at Atascadero, Cal., for the erection of a new plant to manufacture steam-driven automobiles. Plans are being drawn for a building to approximate 100,000 sq. ft. of floor area. J. E. King is representative in charge.

Harley-Davidson Motor Co., Milwaukee, has engaged

the Federal Engineering Co., 444 Milwaukee street, local, to design and supervise the construction of an additional story on its plant, at 38th and Chestnut streets, to be 72 x 138 ft., of brick and steel. William Davidson is factory manager.

Ford Motor Co., Highland Park, Mich., has completed plans for the construction of a new one-story laboratory and mechanical research plant, 200 x 800 ft., estimated to cost about $500,000, including equipment. It will replace 13 temporary buildings of this character erected during the war.

Robert H. Hassler, Inc., 1335 Naomi street, Indianapolis, manufacturer of automobile shock absorbers for Ford and other automobiles, has awarded contract to the Builders' Construction Co., 340 North Meridian street, for a two-story and basement works, 37 x 120 ft.

Haynes Wheel Co., Jackson, Mich., is disposing of a stock issue of $825,000, a portion of the proceeds to be used for extensions. It operates branch plants at Albion, Mich., and Anderson, Ind., with total production of abour 16,000 automobile wheels daily.

Detroit Steam Motor Corp., 38 Hendrie street, Detroit, manufacturer of steam-driven automobiles, has tentative plans under way for the establishment of a branch plant at Windsor, Ont., to be operated under the name of the Windsor Steam Motors, Ltd.

Ford Motor Co., Detroit, is considering the rearrangement of handling raw material in its River Rouge foundry and recently sent out an inquiry for a car dumper with a view of using this for unloading the pig iron, coke and other raw material.

Durant Motors of Canada, Ltd., Royal Bank building, Toronto, will receive bids, no closing date set, for an addition to its plant at Leaside, Ont., to cost $500,000. Plans are with E. A. Walberg, 909 Royal Bank building, Toronto.

New Departure Mfg. Co., Bristol, Conn., ball bearings, bells, etc., announces that preparations for the installation of machinery at a new branch plant at Meriden, Conn., will start immediately. Production will start next fall.

Standard Steel Spring Co., Corapolis, Pa., manufacturer of automobile springs, etc., is taking bids for a one-story addition, 65 x 140 ft. A crane runway will be installed, with 10-ton electric traveling crane, about 60 ft. span.

Daniels Motor Car Co., Reading, Pa., will establish a complete service and repair works in Brooklyn, to be operated as a factory branch for the Long Island district. Philip Jackson has been appointed manager.

Preston Motors Corp., Birmingham, Ala., manufacturer of automobiles, has arranged for a bond issue of $300,000, and stock issue of $800,0000, a portion of the proceeds to be used for extensions and improvements.

Henry Ford, Detroit, is reported to be planning for the purchase of property at Carolina and 4th streets, Buffalo, to be used as an eastern plant for the Lincoln Motor Co., an affiliated interest.

G. A. Schacht Motor Truck Co., Cincinnati, has leased the building at 13th street and Ely avenue, Long Island City, recently completed, for an eastern service and repair works.

Ryan Foundry Co., Lansing, Mich., has taken an order for castings for 100,000 motors for the Grant Motor Co., same city, and is arranging for immediate increased production.

Rowe-Stuart Motors Corp., Lancaster, Pa., has plans nearing completion for a new plant, 270 x 325 ft., on Fountain avenue, for the manufacture of motor truck equipment.

Canton Rim Co., Canton, O., which recently purchased the plant formerly occupied by F. R. Fortune Tool Co., Wooster, O., will enlarge the building.

Moon Motor Car Co., St. Louis, has adopted a production schedule call for 1,000 complete cars during each month of July and August.

Simplex Lock Rim Co., Petersburg, Ind., will build an addition to its plant, 30 x 70 ft., to manufacture metal rims for automobile wheels.

Vesta Battery Co., southwest corner Indiana avenue and 21st street, Chicago, is making alterations to its plant to cost $8,000.

Ford Motor Co., Detroit, Mich., is reported to be negotiating for a site for an assembling plant at Hammond, Ind.

Additional Notes of Body Builders

(Continued from Page 30)

automobile bodies, busses, etc. The company is headed by H. R. and E. R. Chupurdy.

Wilson Body Co., 1440 Clay avenue, Detroit, has awarded contract to the F. R. Patterson Construction Co., Ford building, for the erection of a three, four, five and six-story addition, estimated to cost about $200,000. C. R. Wilson is president.

American Motor Body Co., 18th and Lehigh streets, Philadelphia, operated by the Hale & Kilburn Co., is arranging for increased production, following the receipt of a contract from the Durant Motors, Inc., New York, for 50,000 car bodies.

Collings Carriage Co., Arch and Federal streets, Camden, N. J., manufacturer of automobile bodies, has plans under way for extensions and improvements in its works. Lackey & Hettle, 5 Hudson street, are architects.

Clayton Co., 136 W. 52nd street, New York, manufacturer of automobile bodies, has leased the eight-story and basement building at 427-31 W. 42nd street, 69 x 100 ft., for a new plant.

Safe Storm Shield Co., Fremont, O., plans to erect a three-story brick factory, 66 x 132 ft., to manufacture automobile tops and accessories.

Kastory Mfg. Co., manufacturer of automobile bodies, La Grange, Ill., has let contract for a one-story plant, 100 x 125 ft., to cost $28,000.

Edwards Wheel & Body Co., 204 Washington street, Dallas, Tex., has filed plans for a new one-story plant.

Electric Vehicle Men Hold Beach Party

With 70 members and guests present, the Electric Vehicle Bureau, Met. District, N. E. L. O. held a shore outing on July 11. The afternoon was spent at Manhattan Beach with swimming and a ball game as the attraction, and the evening was spent at Tappen's Inn, Sheepshead Bay, where a shore dinner was enjoyed.

The Electric Vehicle ball players defeated a scrub team 13-11 and in the dinner came out victorious over a whole mess of clams, lobsters, fish and other salt water delicacies.

The party assembled at Irving Place and Fifteenth street and made the trip by automobile.

The United States spent $600,000,000 for roads in 1921, according to estimates of the Bureau of Public Roads, United States Department of Agriculture. This sum was derived from the following sources: Local road bonds, 33 percent; county, township, and district taxes, assessments, and appropriations, 14 percent; state taxes and appropriations, 12 percent; state road bonds, 7 percent; motor vehicle license revenues, 19 percent; federal aid, 14 percent, and miscellaneous sources, 1 percent.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

2277—A merchant in Spain wishes to purchase paints and varnishes of all kinds. Quotations should be given c. i. f. Spanish port. Correspondence desired in Spanish. References.

2283—A commercial agent in South Africa wishes to secure the representation of manufacturers to cover the Transvaal of a cheap motor tire; and agricultural implements suitable for conditions in South Africa. Reference.

2296—A mercantile firm in South Africa wishes to purchase factory first automobile tires. Quotations should be given c. i. f. Durban or f. o. b. vessel, New York.

2297—The purchase is desired by a mercantile firm in England of 3/8 and 5/16 inch diameter cup square bolts and nuts of various lengths for coach building. The first order will be for 2,000 gross. Quotations should be given c. i. f. port of England. Reference.

2300—A firm in Belgium wishes to secure an agency from a manufacturer for the sale of a windshield cleaner for automobiles. Reference.

2302—An agency is desired by a firm in Italy for the sale of motor cycles. Correspondence should be in French or Italian. Reference.

2309—A firm in Australia desires to secure an agency for all kinds of automobile accessories. Quotations should be given f. o. b. New York. Terms: Cash in New York. References.

2311—The purchase is desired by a city of Canada of a 2½ ton automobile dumping truck, suitable for hauling gravel over dirt roads. Quotations should be given f. o. b. destination or port of shipment. Reference.

2312—An importing firm in Spain wishes to purchase aluminum sheets for automobile bodies and machinery for working said metal, and electric ovens for varnishing and enameling automobiles. Quotations should be given c. i. f. Spanish port. Terms: Cash against documents or letter of credit. References.

2313—The purchase of white mineral oils is desired by a corporation in Italy. An agency is also desired. References.

2361—Automobile supply dealers in Norway desire to purchase and secure an agency for the sale of piston rings (lock joint and step joint). Quotations should be given c. i. f. Norwegian port. Payment to be made through banks in Norway and New York. Reference.

2422—A merchant in Italy desires to secure an agency and purchase pneumatic tires and automobile accessories. Quotations desired c. i. f. Italian port. Correspondence should be in Italian or French. Reference.

2455—The purchase of mineral oils, especially lubricating oil (cylinder oils), benzine, and paraffin, is desired by a firm in Czechoslovakia. Quotations should be given c. i. f. German, French, or Holland ports. References.

2220—An inquiry has been received from a merchant in South Australia for an agency for farm tractors, preferably of the caterpillar type, and wheeled tractors as well. Quotations are desired f. o. b. New York, or c. i. f. Australian port. References.

2261—A manufacturing company in Canada wishes to purchase artificial leather for automobile-top material, and materials and supplies for jobbers in the automobile-top repair trade. Quotations should be given f. o. b. shipping point. Reference.

2461—A city in Mexico is in the market for one or more street sprinklers suitable for using salt water, and to be mounted on automobile chassis or trucks. Quotations desired f. o. b. factory. Payment: Cash with order. Correspondence should be in Spanish.

2543—The purchase of supplies of all kinds connected with the automobile trade is desired by a firm in Sweden. Quotations should be given f. o. b. New York. Reference.

2548—A company in South Africa desires to purchase and act as agents for the sale of motor accessories, tires, and mechanical rubber goods. Quotations should be given c. i. f. Durban or f. o. b. vessel in New York. Payment to be made against documents. Reference.

2549—A mercantile firm in Canada desires to purchase automobile accessories. Quotations should be given f. o. b. factory. Cash to be paid. Reference.

2550—A merchant in Italy wishes to secure an agency and purchase typewriters, motor cars, bicycles, and motor cycles. Quotations are desired c. i. f. Italian port Correspondence should be in Italian or French. Reference.

2722—A mercantile firm in Australia desires to secure agencies for the sale of all kinds of automobile accessories. Quotations f. o. b. New York. Cash to be paid in New York. References.

2756—A dealer in automobiles, trucks, motor cycles, tires, tubes, and other automotive accessories, in Siberia desires to secure the representation of manufacturers of all kinds of makes of these products. References.

2766—A wholesale merchant in Italy desires to purchase and secure an agency for figured and plain oilcloth in 12-yard pieces, and cork linoleum. Quotations c. i. f. Italian port. Terms, payment against documents in Italian bank. Correspondence, Italian or French. Reference.

2781—A mercantile firm in Sweden wishes to purchase bicycle and motorcycle chains, parts for motorcycles, motors, and other parts in the automobile and motor trade; and also secure an agency for the sale of a good automobile to cost about 4,000 crowns in Sweden. Quotations, c. i. f. Swedish port. Reference.

2784—A merchant in Italy desires to secure an agency from manufacturers for the sale of hardware and tools, and automobile accessories. Quotations, c. i. f. Genoa. Reference.

2837—A mercantile company in Syria desires to purchase sporting goods, bicycles and motor cycles. Quotations, c. i. f. Beirut. Terms: 25 percent with order and balance against documents. Correspondence, French. Reference.

2840—An industrial firm in South Africa desires to purchase stoves for baking enamel on automobile bodies. Reference.

2903—A mercantile firm in Spain wishes to purchase or secure an agency for automobiles and accessories. Quotations, c. i. f. Spanish port. Correspondence, Spanish or French. Catalogs and price lists are requested. References.

2971—A merchant in Italy desires to secure an agency for the sale of imitation leather for the furniture and automobile industries. Reference.

The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1, Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3, Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING • AUTOMOTIVE PARTS • ALLIED INDUSTRIES

Vol. LXIV. No. 5 AUGUST, 1922 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City. Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3.

The Automotive Manufacturer

A Consolidation of The Hub and Automotive Engineering

Vol. LXIV. NEW YORK, AUGUST, 1922 No. 5

Overcoming the Drawbacks of the Detour

How Various Progressive States, Rebuilding Their Roads to Meet Modern Conditions, Have Arranged to Insure the Motorist Comfort*

DETOURS have always been difficult to handle, in fact in the earlier days of motoring, they were not handled at all. The motorist simply had to find the best way he could around the section of road under construction. Now-a-days, these matters are handled much better for the majority of the road work is being managed by a state highway department or commission, and the motorist, deprived of his road surface during construction and not advised of an alternate way, rightly blames the department (or commission), and they soon hear from him. This being the situation, the highway department, in self protection is now planning its detours around road improvement work almost as carefully as the work itself.

Fig. 1. A detour like this is not likely to get the good will and co-operation of motorists in highway construction programs.

Both Good and Bad Methods

It may be said of conditions at the present that there are good methods and bad methods of handling the detour problem, and the majority of highway departments, notably Wisconsin, Minnesota, Massachusetts, Connecticut and others, are handling the situation in the good way. In what follows some of these good ways will be illustrated and described. Where little attention is paid to providing detours motorists are not getting the service they have a right to expect from their highway departments. The pictures show how various states are handling traffic on roads under construction. If a detour is necessary it should be well maintained, plainly marked, and easy to follow. If the construction work is done half at a time motorists will not only save time by following the shortest route but will also gladly put up with the slight inconvenience involved because of the progress they see made toward a modern, hard surfaced highway.

Fig. 2. In Minnesota the traveler is not only warned that his road is under construction, but he is directed over alternate routes.

The state of Wisconsin has shown such progressive ideas toward road work that these highway policies have come to be called the "Wisconsin idea." The general plan in use in that state includes not only the permanent improvement of the main trunk routes but makes special provision for the handling of existing traffic. The principal objective is to satisfy the traveling public, and the system is considered as having failed if the traveler is not properly and adequately directed. Especially is this true of detours, so this state attempts the good method.

During the 1921 construction season upwards of 300

* Cuts and data kindly furnished by Portland Cement Association, Chicago.

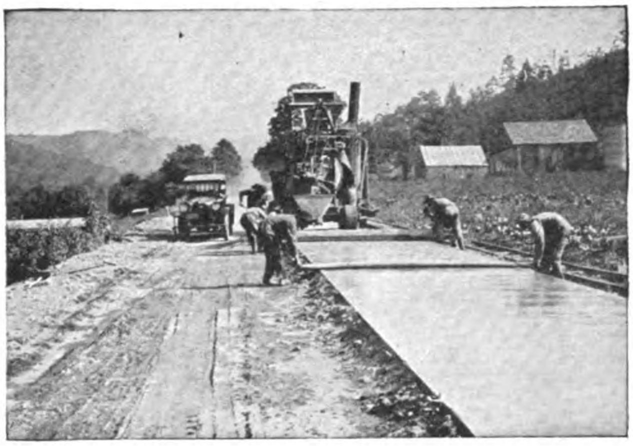


Fig. 3. In Connecticut roads are built half-at-a-time and traffic is then saved a longer trip over an alternate route.

Fig. 4. A hard pull through a sandy detour. Motorists using this detour are not getting full service from their highway department.

highway construction jobs were under way in that state, upwards of 100 of these being of such a nature as to require detours. Three-fourths of these detours were on jobs being paved with concrete. The state highway department met this situation fairly, and placed great importance upon proper marking, maintenance of detours.

Before a road is closed for construction a detour is selected and marked. This, then, automatically becomes a part of the state trunk highway system and is maintained under the patrol system as a trunk highway. Maintenance on detours is more intense than on the regular highways, because the detour roads have not previously received the systematic attention given the trunk highways. An effort is made to have the detour in as good condition as the main traveled highway.

Standard Detour Signs

Standard road signs (Fig. 5) have been adopted by the highway commission, and every detour is marked so that the motorist will have very little trouble following the route. At each end of many of the longer detours a large wooden sign is placed, on which is painted a map, showing the road under construction, the detour and the location of railways and cities (Fig. 10). An arrow points to a spot on the map with the notation "you are here." The map enables the motorist to get a general impression of the length and direction of the detour, and this, reinforced by the markers along the route, will enable him to follow the detour without trouble. At least four markers are placed along each mile of detour, and a marker is placed at each side of every road intersection. Markers are white boards bearing the Wisconsin standard highway symbol and the number of the highway, with the addition of the word "detour." At all turns a large "R" or "L" is added to the sign to warn the motorist to turn to the right or left as indicated. The signs are fastened to angle iron posts which are easily removed when the main road is again open to travel.

Fig. 5. Plainly marked detour signs are a great help to motorists in Brown County, Wisconsin.

In addition to the markers, night signs are placed at all dangerous right angle turns. These are 20 by 40 inches in size, and are placed about 3½ ft. above the ground so the lights from the automobile will strike the sign and warn the traveler of the turn while he is still 200 or 300 ft. away. The night signs bear the number of the route and a large arrow, pointing in the direction of the turn.

The "Highway Information Service"

The commission conducts a highway information service which has proved to be of great help to motorists. A blueprint of the state trunk highway system is furnished weekly to all subscribers. The map shows the type of road on every mile of the system, the location of all construction jobs and of all detours, and conditions of detours

Blueprints are made from a tracing kept in the maintenance engineer's office at Madison. The map is revised weekly. Information on all construction jobs and detours is received from the district offices on Tuesday of each week. These data are marked on the tracing with heavy soft pencil and new blueprints are sent out on Wednesday so that every subscriber will receive an up-to-date map on Thursday, in time to supply information for week end motor trips. When a job is completed or a detour changed the pencil marks on the tracing are erased or revised.

The highway information service is sold to hotels, commercial associations, automobile clubs and other places where touring information is sought. The map is 54 by 60 in. in size and is mounted on a frame or bulletin board placed in a conspicuous place in hotel lobbies or offices.

(Concluded on Page 29)

Fig. 6. When the half-at-a-time method permits only one line of traffic, this can be regulated by a telephone, as in Massachusetts.

Need for Better Automobile Carriage Designers

Definition of the Position the Carriage Designer Ought to Occupy in Modern Automobile Plant—Coach Work Now More Important Than Mechanism

BY SIR HERBERT AUSTIN, K.B.E., M.P.

DECLARING in substance that the mechanical side of automobile manufacture has progressed to such a point, has reached such a stage of perfection, that mechanical perfection may be taken for granted, while such is far, far from the case with body design and construction, the speaker before a recent meeting of the Institute of Motor and Coach Builders, London, started in this way a most interesting subject and an equally interesting discussion.

He said further that while he had not a great deal of time to prepare an address, he firmly believed that the need for better trained automobile carriage designers is one of the chief difficulties the carriage building trade is suffering from at present. Continuing, he said, I do not propose to go back into ancient history any more than to make a few references, because I do not think it would assist us very much. At the same time I want to suggest some few things as to the evolution of carriage design, because I believe some of the difficulties, which were in operation years ago, still remain.

I believe we should give much consideration and thought to the position of the carriage designer and engineer to get rid of some of the difficulties, and put this man into a better and more responsible position than he is today.

We want to make the carriage designer in our factories a more capable and responsible official, and if we did so, I believe some of the things we see running about today would not exist. We should be able to make the position of automobile manufacture and design throughout the world much better than it is at present. Today the carriage builder simply puts a lot of carriage work—or at any rate, bits of wood work or metal into a certain shape on a motor chassis, to carry people about in more or less comfort.

I have the highest admiration for the old carriage builder, because at the date motor cars came into existence, I consider the carriages built in this country, and one or two other countries, were the best in the world. There was nothing to find fault with on the point of design or usefulness for the work for which they were required. I do not suggest that this was achieved at the outset, as a good deal of the work was a matter of evolution.

I remember my first steps to get bodies built on early motor car chassis. I had to go to the carriage builder, and he impressed me very much. The thing that impressed me most was, that the man who built the carriage was a very independent type of person. So far as I saw, he was left to build the coach more or less as he pleased.

The customer usually gave his order from rather an elegant drawing or picture. The coachbuilder may have had a look at the drawing, but he certainly had his own ideas as to various curves, etc. In fact, the coachbuilder was somewhat of an artist who evolved distinctive designs. Today, the designer for automobile bodies is more of an artist than a designer. He makes a drawing embodying thousands of various shaped curves—the drawing goes into the shops, and the foreman of the shop, or superintendent, comes along, finds fault with something or other, and gives instructions on his own authority for a change to be made.

I am not suggesting that the man in the shop is a better designer than the designer himself, or otherwise, but I do believe the designer himself ought to be in a position of authority, and that he is the better person to make any change. I simply approach the question from the point of view of carriage design as applied specifically to motor carriage work, because most of us have today put carraiges on the shelf.

I do not know how many of us are building carriages today. I am not, and I limit my remarks entirely to the question of design from a motor car point of view. It will perhaps be better to take the practice in our works into the discussion because we have a fairly big works, and I believe our organization is as good as other motor car makers in this country.

In the first place we design the chassis, and then we get the carriage work on to it. I maintain this is wrong. Some day or other, we shall come to the conclusion that this is the wrong way to design a car. It results in a £1/2,000 chassis being taken to a coachbuilder to do the best he can within the limits imposed upon him by the chassis designer, with the ultimate result that the passengers' seats are found in the most uncomfortable position, while the chauffeur has got the best position. This is wrong.

The carriage designer is a man today getting possibly half the salary of a chassis designer. The chassis side is considered to be a very important position, in which a very great deal of knowledge is required, but the carriage design is only a matter of lines and curves. While we do go to the extent of drawing a complete car, this has to conform to the chassis—at any rate, the first thing we design is the chassis.

The chassis design is then handed over to the carriage man to complete in the best manner he can, within the dimensions and limits provided by the chassis designer. The carriage designer is never consulted on the question of center of gravity, length and periodicity of springs, wheel track, width of chassis, and one hundred and other things that affect the successful building of a carriage body. He generally appears as an artist who designs curves, etc.

These are the things that exist today in motor carriage building in this country.

There are many firms who build elegant bodies from the point of view of shape and lines, but these in many cases do not come anywhere near providing that comfort for the owner they should provide.

One firm in Belgium does appreciate it, and they took into consideration some of the salient features, but you must admit there is a very large number of others on

this side and on the other side of the water, who do not.

I maintain this is all wrong. It is wrong from the point of view of the industry—wrong from the point of view of the vehicle. I consider and believe the man who designs the carriage work ought to be, so far as his position and responsibilities are concerned, the chief designer in the motor car factory. He ought to have far more control, and far more responsibility over the complete article than the man who designs the chassis. He ought to be in a position to say to the chassis designer—"I want certain dimensions"—"I want certain bearings"—"I want the controls to be arranged for the convenience of the man who is going to drive the car."

I do believe we have a great deal to learn, and a great many difficulties to overcome yet before we get a perfect car, and the sooner the Institute of Carriage Builders in this country takes up the matter from the point of view of improving the position of the man who has to design the carriage work, the better it will be for all concerned—the chassis manufacturer, the carriage builder, and the motorist. This is a strong statement to make, but I feel I am speaking to people who understand, and will appreciate with satisfaction the benefits to be obtained, and I hope my remarks will be accepted with a desire to improve the carriage building industry in this country.

The exhibition at the Paris salon last year was a most unsatisfactory one. I consider the position from the point of view of carriage design, was the worst I have ever seen in Paris.

Another point is quality of carirage work from the point of view of finish. This could be improved.

If I see things correctly, surely one thing we desire as a carriage builders' institute, is a general improvement from the point of view of quality and design. Today this institute has got a number of things to consider to see that the next Olympia show is vastly improved from the standpoint of design, finish, and multiplicity of bodies and curves.

The carriage designer to be successful in the future, will have to study mechanics, if he wants to get the position I have outlined, and to take responsibility for the finished car. He has got to be a thorough mechanic from the point of strengths and stresses of metal, and use his knowledge in the same way as the engineer. He will need to be a mechanic far more than an artist.

I consider the sooner we recognize it is necessary to improve the position, knowledge and capacity of the carriage designer, the better it will be for our institute as a body, and manufacturers of motor carriage bodies as a whole.

Discussion

Mr. Couch (Daimler Co.): I am sure I am right in voicing the thanks of everyone to Sir Herbert for the tactful and forceful way in which he has clearly set out the position as it exists today. I am only sorry he was unable to be present at our meeting at Bristol last year. At the meeting at Bristol we had a somewhat acrimonious discussion on one of the points mentioned by Sir Herbert, i.e., the relationship of the chassis designer to the carriage designer. Sir Herbert has most certainly got the feelings of the institute with him on the point that the chassis designer should be made to toe the line and design the chassis so as to enable the carriage designer to make an improved and suitable design of body.

Mr. G. Hilder Jacobs: I would draw attention to the good work now being done by the London Polytechnic Schools where youths are being trained as engineers and coachbuilders. The result will, we all believe, be eminently satisfactory and enable us to have engineer draughtsmen who will be competent to take such a position as has been outlined by Sir Herbert. Mr. Hilder Jacobs then cited certain instances recently, where difficulty had been experienced in providing a body for chassis that was really designed without any thought as to how the intended passengers would get that comfort they had every right to expect. Mr. Jacobs also referred to the difficulty experienced with blueprints which are often incorrect, and result in alterations to the body when it is ready for attachment to the chassis.

Mr. Lawton Goodman: The difficulty the coachbuilder has to cope with today is very aptly described by Sir Herbert as due to mis-direction and lack of knowledge on the part of the chassis maker in building chassis without any thought as to the type of body to be put upon it. The difficulties are manifold, due to various things such as length of chassis, wheel track, length of steering arm, bolt plates, change speed lever, etc. The coachbuilder has had to carry the burden of these for many years past, and it is regrettable to me to hear so eminent a member of the motor world acknowledge this is so. Some time ago Van de Plas designed a body first, and the chassis was then designed to suit the body. It is a laudable thing for Sir Herbert to appreciate our difficulties and we must thank him for a very excellent address.

Mr. J. White: I congratulate Sir Herbert on the excellent paper he has given. He has done a great service, and provided us with food for though during the next few months. At the present time, we, as carriage builders, have no scope. We have to put on bodies that will suit the chassis. I am sure we, as an institute, should be the very first to take advantage of the opinion provided by Sir Herbert, and lay before the S.M.M. & T. our views on this subject. One cannot help feeling that since the war there has been a great shortage of capable designers—since seven years were lost, the young men who were trained, have gone, otherwise we might have been in a very strong position. Eighteen to 20 men will be leaving the Polytechnic school very shortly, and I would appeal on behalf of these young men, that you should take them and bring them out as practical and efficient coach designers in every way. I very much regret we do not have the pleasure of listening to Sir Herbert on more frequent occasions, because I feel sure that his views on these important matters are invaluable, and do much to consolidate our institute and help the whole industry. We recognize the name "Austin" as a world-wide one, and we feel he is a national asset. He has built up one of the largest concerns in the world, and we wish him the best possible success in the future.

(In the course of his reply Sir Herbert gave some interesting details of a car he has designed of an entirely new type, which will provide a new note to motor car practice as it is known today.

The British Ministry of Transportation has decided to invite suggestions for a new method of motor-vehicle taxation that will lighten the motorist's burden without decreasing the government's revenue. This is the result of an expression throughout the country against the high taxes on motor vehicles on the horsepower basis.

Solving the Motor Camping Problem

How Various Municipalities and Towns Have Handled This Situation—Great Growth of Motor Touring Since Camping Sites Became Available

MOTOR camping has become a recognized way of spending a vacation on the road, out in the fresh air, and one that is rapidly gaining popularity. One of the things which has done much, perhaps the most, to increase this popularity is the provisions made for such motor campers by various cities and towns. This has taken the form of a simple park in which motorists are allowed to pitch their own tents and to build fires for cooking purposes, and it also has much more elaborate forms. In the latter it includes the provision of everything the motorist could wish for in the way of water for drinking and for washing the car, a washing platform where this may be done easily and quickly, fireplaces and fuel, toilets, drained camp sites with some provisions to assist campers in preparing their equipment for the night, tables and benches for eating places, signs directing motorists to the place and adequate lights at it, outdoor shower baths, garbage incinerators, etc.

Naturally the spread of motor camping has not come in a minute. In fact, four or five years ago, it was a rare sight to witness a motor car with a trailer attached for carrying the camping outfit, or with camping outfit and baggage fastened securely to the running board and cooking utensils and the like packed away in the rear of the car, speeding along the highways headed for the great open country. In those days few persons indulged in camping.

Perhaps it was because of the belief harbored by many that camping out meant the undergoing of hardships and deprivations, rather than a comfortable and pleasurable pastime. This false idea during the past few years has been abandoned and now during the long summer days one sees any number of motor cars headed towards the mountains, the forest reservations or the country, each ladened with a complete camping accoutrement.

In past years camping trips were usually confined chiefly to the great national forests and public camping grounds in the west, but conditions have changed and now camping trips may be indulged in in almost every part of the United States. This is made possible by the establishment by municipalities of public motor camping sites, many of which are located on the outskirts of the cities and towns far from the din of the busy streets.

Mountain regions, where wood and water is available, are, of course, the best camping localities, but some fine motor camping grounds are to be found in the municipal camp sites recently established in hundreds of our most prominent American cities.

This is true of the New England states where the camping-out spirit has taken a firm grip upon hundreds of owners of automobiles. Where once many of these persons were content to tour the land and make night stops at hotels or farmhouses, they now delight to journey into the forests of Maine, the White Mountains of New Hampshire, the Green Mountains of Vermont, the Berkshire Hills of Massachusetts, the Catskills or Adirondack Mountains of New York, or the mountain regions of Pennsylvania, Virginia or some other state, and pitch their tents.

Augusta, Me., has provided well for her visitors by establishing a well-equipped automobile camping grounds directly opposite the state capitol in a nine-acre park known as Capital Park. This camp is admirably located high above the winding Kennebec with a commanding view of the surrounding country and yet far enough away from the heart of the city as to be quiet and undisturbed by the turmoil of the city itself. From an observation stand far out on the brink of the river can be seen the beautiful Burleigh Pavilion, the state hospital, the old United States arsenal, and a short distance up river, the city itself. This plot of land is one of those rare beauty spots sometimes met with in the heart of a city, a bit of nature's wonderland with its verdure and wild life that is a delight to the tourist.

This camping ground is equipped with chemical toilets, two fireplaces, free fuel, running water, and electric lights. Fresh bread, meat, and groceries may be had from nearby stores, and Augusta has long ago equipped itself to meet the needs of tourists as to automobile supplies, repair work and the like. By an arrangement with the Y. M. C. A., which is located within five minutes' walk of the camping ground, one may secure a hot shower or a swim in the commodious pool at a nominal fee. Thus Augusta

National and Municipal Camp Sites

THERE are numerous motor camping sites in the eastern states, some under the control of the national government and others established by municipalities. A list of these camp sites follows:

Massachusetts—Ware, Gardner*, Marlboro, Marblehead, Northhampton, Pittsfield, Revere, Saugus, Springfield, Salem, Salem Willows and Forest River Parks.

Maine—Augusta and Lewiston.

New Hampshire—Berlin, Keene, Laconia, Portsmouth*.

Rhode Island—In this state there are no camping sites available for motorists in the cities and there are no public forest reservations. It is unlawful to start a fire within 100 feet of woodland.

Vermont—Burlington, Rutland, Northfield.

Connecticut—Madison, Wallingford.

New Jersey—Madison, Wallingford.

New York—Albany: South Bethlehem and Northern Boulevard; Dunkirk, Fredonia, Glens Falls, Herkimer*, Lake Placid, Oswego, Peekskill, Poughkeepsie, Salamanaca, Saratoga.

National Parks

New Hampshire—Copp Spring, Glen Road, south of Gorham; Gale River, road from Profile House to Twin Mountain; Wild River: Tributary of Androscoggin, south of Shelburne.

State Park

New Hampshire—Willey House Site, Crawford Notch.

* Denotes natural campsites.

standing as the representative of the state of Maine, bids her visitors welcome.

Some tour by day and sleep in tents at night, and there are any number of types of tents now being manufactured that can be rolled up and carried in the bottom of the car. When the travelers decide to turn in for the night it is but a few minutes' trouble to erect the tent. Some of these tents are simple in construction, while others are more pretentious and make very comfortable living quarters in all kinds of weather.

Motor camping has solved the summer vacation problem for thousands of car owners and their families, and this problem with the increasing cost of railroad transportation and hotel accommodations has during the past few years become a serious one.

Unlike the motor tourist who is interested in covering mileage and feasting his eyes on the verdant landscapes of the countryside or mountains, the motor camper is simply a tourist until he reaches some attractive spot beside a placid lake or some secluded wooded section. Then he is converted into a camper-out, sheltered under his own canvas roof, where he can stay for any length of time as contented as he would be if domiciled under a structure of wood or brick.

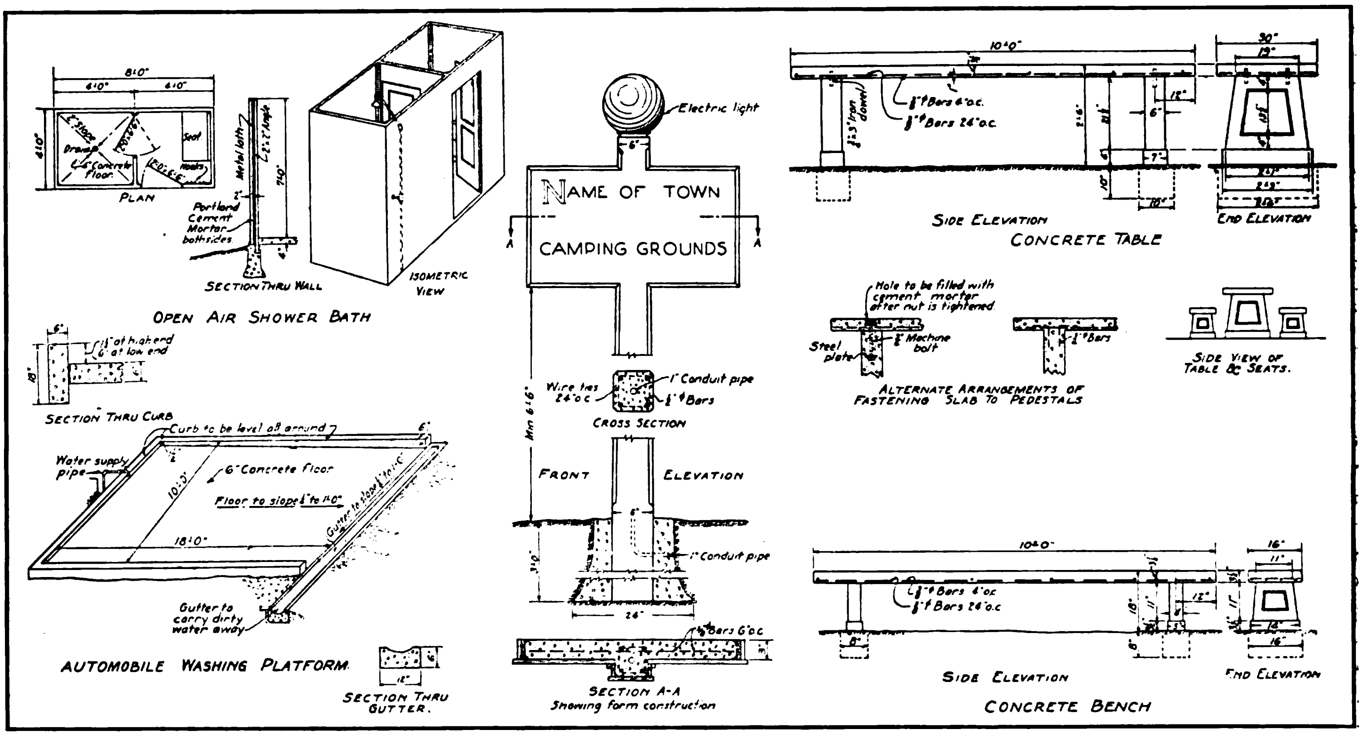
Anyone that can afford to own a motor car can afford a motor camping trip, as the expense is small. There is probably no other method of travel whereby one can cover great distances and view such a variety of scenery in a short time for so small an expenditure. The initial cost for the camping equipage is the greatest expenditure, but this soon repays one in the pleasure and contentment enjoyed, and the camping outfit is usually good for many years.

In planning a motor camping trip, due consideration should be given to the type of tent selected. Make sure that it is insect and weather-proof and you will be spared many annoyance and discomforts. Another important factor is in selecting the camping equipment, for the number of persons taken on the trip must be considered. A motor car, like the human, has its limitations and excessive weight impairs its efficiency. To load the car with equipment, clothing and other sundries not absolutely essential and then take along several full grown persons as passengers is taxing the car's capabilities beyond the limit.

When planning your trip write out a list of the articles to be taken and before reaching a final decision go over the list a second time checking up the various articles and crossing off those that are not a necessity. Each time you go through the list you find some article that can be dispensed with. Compactness in storing the bedding, tent, cooking utensils, toilet articles, first-aid kit, etc., is essential. Why strew them all over the car? Duffle bags are much more preferable to suit cases in carrying camping equipment, for this type of pack rides better. Cooking utensils can be packed more satisfactorily by setting one inside the other. Carry along utensils that are to be used for heating water or boiling vegetables in different sizes, so that one will nest inside the other. They are more convenient than pots of the same size which have got to be placed in the bottom of the car and take up the same amount of room that could be used by one of the passengers. There are regulation cooking utensils manufactured that will pack in together and can be stored away under the seats or some convenient space not used by the passengers. Cooking utensils should be of some light, durable material such as tin or aluminum ware.

Several fundamentals necessary to enjoy a motor camping trip are the comfort of the passengers, compactness of equipment, protection against rain, dust and troublesome insects, that are found in abundance in forest and wooded sections, and perfect running condition of the car.

In selecting a stove care should be used. It is not necessary to purchase a large cumbersome one, for there are



Figs. 1 to 5. Some motor camp conveniences which are readily made from concrete. Fig. 1 (center) sign post. Fig. 2 (upper left) shower bath. Fig. 3 (lower left) washing platform. Fig. 4 (upper right) table. Fig. 5 (lower right) bench.

the camping-out type, or what part is of the touring type which uses hotels. However, two years ago the American Automobile Association found that in a single season not less than 460,000 tourist cars visited the state of Washington, their occupants spending the good round total of $40,000,000. Most of this, needless to state, went out for sustenance. Replies to a questionnaire from about 50 cities and towns where camp sites are maintained indicated that the average motor tourist spent at that time about $5 a day.

A very practical phase of the movement to provide accommodation for campers is brought out by the remarks of Harry Burhans, of Denver, in an address before the annual convention of the Associated Advertising Clubs of the World, at Milwaukee, a few weeks ago.

"The growth of the auto camp in the west has been phenomenal," he said, "and there is not a community in the west but has an auto camp of some kind, and all of our western communities agree that they are a valuable asset. I will cite just one illustration: At Canon City, Col., the merchants, including the butchers, dry goods stores, restaurant men, etc., in 1920, kept separate account of the money spent by strangers who came into their places of business, with the result at the end of the year, this totaled over $116,000, and 90 percent of this was from the tourists who camped in their auto park.

"In Denver, at Overland Park, where we have a camp ground of 160 acres, valued at $250,000, for over seven several excellent makes on the market that are light in weight and can be stored away without interfering with the comfort of the passengers. The gasoline stove is the most efficient and will have the coffee and foodstuffs piping hot in short order. Some of these stoves have a roaster which can be used for baking potatoes or broiling meats or fish. Any first-class sporting goods store carries a complete line of camping equipment, and it would be well to visit one of these stores if for no other purpose than to get a few pointers on what you need.

For the food a large compartment box can be constructed or purchased that fastens to the running board. Such a box will hold a large variety of canned goods and other necessities that may be purchased more readily from your grocer. It is not necessary to take along a supply of vegetables, eggs, milk and meats for they can be purchased from farmers along the road or in small towns. It is however, desirable to include in the luggage a few chairs and possibly a small table, all of the compact folding type, since many towns which have camping sites have not as yet provided either tables or chairs, and when camping on other than town or city camping sites, they are almost a necessity. A congenial crowd can "picnic" or sit on the ground and eat a meal or two, but if carried further than that it is likely to spoil the whole trip.

In selecting a camp site, do not pitch your tent until you have investigated the land and found that it is dry and free from any annoyances and inconveniences. High locations are by far the best if adjacent to good drinking water, preferably a spring. When you are satisfied that you have found the ideal camping location search out the owner or caretaker of the land and ask his permission to use the land. That is the most courteous way to act and you will then feel more contented. When leaving the grounds do not fail to pick up the refuse that has accumulated, in that way you will be making a lasting impression upon the owner of the property and he will extend the same courtesy to some other motorist as he extended to you.

One important matter that should not be overlooked relates to starting fires. Many localities have issued fire regulations forbidding the starting of open fires in forest or wooded localities. These communities have an official who is in charge of fire prevention and it is advisable to consult him before attempting to start a camp fire. But as many of the camping sites are equipped with fireplaces for cooking purposes it will not be necessary in that case to start a fire in the open.

In going on a motor camping trip it is advisable to bring an axe along with you to cut wood for the fireplace. Most public camping sites permit one to use all the wood they wish, but where camping is done on private grounds you will have to find your own wood and cut it up. In addition to an axe bring along a round nosed shovel. It will prove of inestimable value in putting out the embers

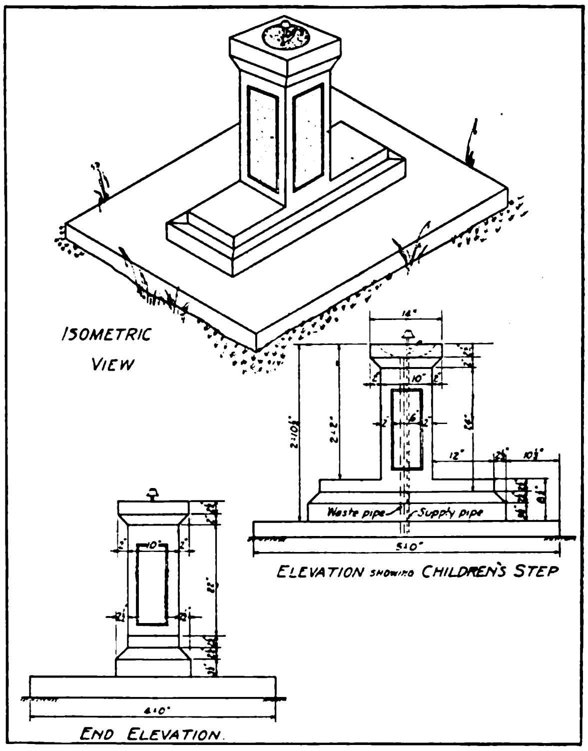


Fig. 6. A drinking fount is almost a necessity in a public camp.

from the fire and also in getting the car out of sand or mud holes.

If you intend to travel far do not overlook certain additional accessories for the car, such as spare tires and tubes. You should also take along a supply of gasoline. Containers that hold from two to ten gallons can be purchased at any of the leading accessory houses. A couple of kerosene oil burning lanterns should be included in your list of necessities. You will find ample use for them at night.

Many motorists start out on their camping trips the latter part of June, but the ideal time is after July first when the heat from the sun, beating on the city streets, is almost unbearable. So plan your motor camping trip now. You will delight in the sport and return well rested and full of vigor.

Figures on the number of motor campers are almost impossible because knowing even the number of tourists, one cannot know what part or percentage of them is of

weeks last summer, there was a little city of over 5,000 people a night. There were nearly 40,000 people who camped in the park last year. They are furnished with free light, mail delivery, free laundry, police protection, camp grounds are lighted, and each camper registers and is assigned a lot and block number. There is a large club house in which there is a restaurant, a grocery store, a pool hall, a barber shop, and shower baths for men and women; these are also free. There is a dance hall which will accommodate 800 people of whom the charge of five cents a dance is made. A playground for children, with swings, teeter-totters, slides, etc., is provided.

"The camp at Overland Park plays a large part in creating this condition: Our leading merchants say that August, which formerly was the poorest month in the year in the retail business, is now next to December the best month in the year.

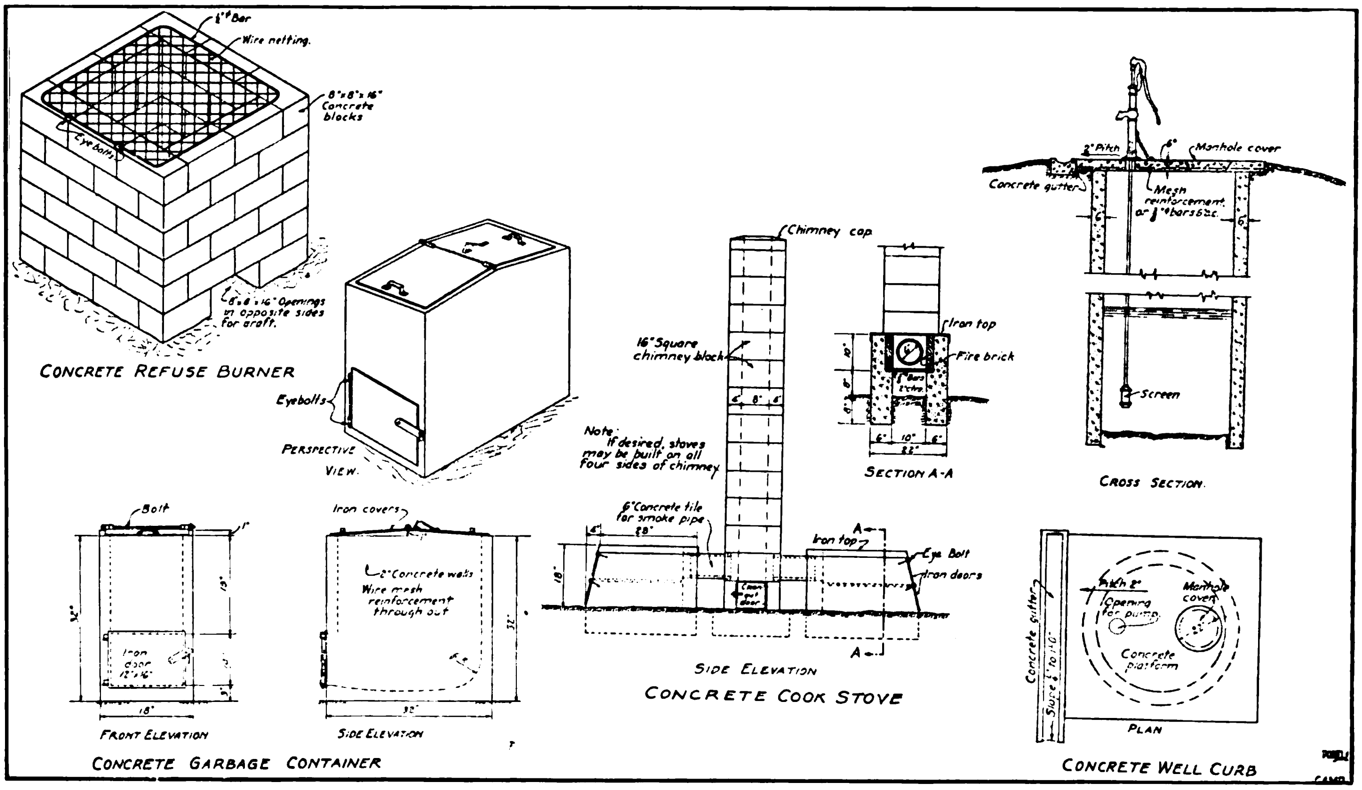
"Every state in the Union, except Delaware, was represented in the auto camp last year. Kansas led with 7,990 people. Here are some of the figures:

stopped in hotels; last year 60 percent camped and 40 percent stopped in hotels."

So, it appears, there are two sides to it, yes, three. First: The motor campers have to be taken care of, or they will dispose themselves wherever fancy or ignorance may guide them. In the east they are liable to bivouac on the velvety lawns of private estates, thus becoming a public nuisance. In the west many of them would seek out ill-favored spots to their own harm, perhaps becoming ill or otherwise distressed.

Second: By providing for the motor campers properly, there is possible a rich harvest in small sales at reasonable profits of such supplies as are necessary to their well being. The third, and advertising phase, appeals more to the west than the east. For it appears that few communities east of the Mississippi are especially solicitous for the good opinion of strangers, whereas westward, civic pride blooms on every bush.

Part of the other side of this question has been raised by Dr. Henry Van Dyke, who said recently in the New York Times Book Review:



Figs. 7 to 10. More concrete camp conveniences. Fig. 7 (upper left) refuse burner. Fig. 8 (lower left) garbage container. Fig. 9 (center) cook stove. Fig. 10 (right) well curb.

	People		People
Kansas	7,990	Iowa	2,401
Nebraska	6.070	Texas	1,914
Colorado	4,727	Illinois	1,727
Missouri	3,253	California	1 587
Oklahoma	2,926	Ohio	924

"In the west we have found the camp a very desirable adjunct, because it is our business to populate, and special committees of the Chambers of Commerce go to the camps in the evenings and talk to the campers about the advantages of their communities. At Loveland, Col., last year, seven families who had camped the previous year at their park are now residents of that little city. In 1915 about 20 percent of our travel was automobile; in 1921 it was about 50 percent; in 1912 100 of the automobilists

"But a very practical question in regard to the conservation of America's wonderful resources of natural beauty is raised by the arrival of the automobile and the hordes of new campers. Here is a new condition, a new peril and a new opportunity. The best place to study it is in the national parks.

"Few people realize the amazing growth and importance of the problem. In 1908 the visitors to the parks numbered 69,000. In 1920 there were 919,000. This year the number may easily pass a million. In 1916 there were 29,000 private automobiles entering the parks. In 1920 the number had risen to 128,000, an increase of more than 400 percent in four years. Most of the people in these cars belonged to the tribe of the new campers. Even if it

were possible, no true lover of nature and of mankind could wish to turn them back, to reduce their number or to check their increase. In fact, the more of them there are the better it will be for the future of the American stock. * * *

"To them the automobile is a boon from heaven, a machina ex Deo. They leap into it, tie their tents and blankets on the running boards, fill the tonneau or panneau, or whatever they call it, with cooking utensils and provisions, perhaps attach a 'trailer,' with beds and other luxuries, fill up the interstices with children and dogs, and sally boldly forth to camp out and 'shake hands with my friend nature.' * * *

"How much will they see of her? As the French say, 'That depends.'

First, they must travel slowly, whether they have a high-powered car or a Ford. Nature yields nothing to the man who is in a hurry. You cannot really see a landscape at 20 miles an hour.

"Seond, they must not leave a trail of debris and desolation behind them. They may see a new glen in all its pristine beauty, but if they leave it spoiled they will never see another, for the curse of Pharaoh will fall upon them, and their hearts will be hardened in their vulgar, greedy breasts. Some of these ruinous campers you may track all along the road as you could trace the march of the German army in sunny France, by the vestiges of their barbarism. These are not nature lovers, but nature muckers.

"Third, they must bring with them some power of appreciation and a great deal of patience. They must not be always looking for miracles and marvels. Nature is like a good woman, her reserves are an essential part of her charm."

One estimate has it that over a million people enjoyed the benefits of motor camping in this country last year. Probably that is just a guess. It is difficult to see how a close estimate could be drawn, since there is very little known data to work on. A million is a nice round figure and may be no exaggeration.

Similarly, it is said there are 1,500 cities and towns that now provide free camp sites. Probably 1,000 would be nearer the truth, though here, again, it is difficult even to approximate.

The A. A. A., in its official "Camping and Camp Site Manual," lists almost a thousand sites. These are located in 37 states and the District of Columbia. California, where love of outdoors is strong, heads the list with 155 such camp grounds. Montana has 72; South Dakota, 59; Washington, 47. Some states have only a few. For instance there is but one officially listed in each of the states of New Jersey, New Mexico, Vermont and North Carolina. Arizona, Kentucky, Louisiana, Massachusetss and Virginia, each have two. Tennessee and Maine each have three, Utah four, Nevada five, and so on.

These camps are variously maintained by chambers of commerce, townships, automobile clubs, community clubs, business men's leagues and other civic and public-spirited bodies. In many instances enterprising garagemen have provided free camp sites within easy access to their places of business. There are, in addition, many camp sites scattered all over the country, where a small fee is charged, say 25 or 50 cents a day.

If there is sufficient public spirit a free camp ground may result as a means of advertising the community and drawing trade for local markets and shops. Otherwise private initiative may seek to turn the public need into profit. In that case the charge must be moderate, or the people will stay away, and the place must be properly maintained, or only an undesirable element will come in. Either way, it is a business proposition pure and simple with the laws of trade governing.

Facilities offered at public camp grounds may include any or all of the following: General store, rest house, kitchenette, outdoor-ovens, tables and benches, amusements, firewood, water, shower baths, swimming pools, playground for children, electric lights, tent floors, sanitary arrangements, including toilets, garbage receptacles and refuse burners and finally police protection. In some instances an aeroplane landing is advertised as a feature.

The camp maintained by the city and county of Denver, previously referred to, is probably the most widely known in the country, if not in all respects the best equipped, as it probably is. This location—Overland Park Camp, it is called—is three miles south of the business center of the city. It is not only a haven of refuge for the weary tourist, but a big advertisement for the city and a profit-making institution besides.

Motor camps, properly set up and maintained, have proved all of this for hundreds of other communities. They were started, almost without exception, in self defense. These new-style vagrants had to be taken care of in some way. They were far from being tramps, although appearances were generally against them. Under the dirt and tan lay a good deal of wit, wisdom and experience. Poverty was lacking, too. The amount of the story was that a great and growing class of typically American people, nomads by instinct, preferred the road to the summer resort and were out "seeing America."

Overland Park Camp Widely Known

Denver's example has been widely and profitably followed, with the result that civic bodies are the principal sponsors for the motor camp site movement. There are a few noteworthy exceptions, however.

The state of Michigan, for example, maintains 20 completely equipped camp sites in as many different towns. One or two of the great park reservations in the state of New York have more or less well-equipped camp sites, though not particularly for motorists. The national parks, or several of them, are similarly provided with recognized camping spots, having more or less in the way of fixed accommodation. At General Grant National Park, in California, for example, the government maintains and rents out tents, utensils and other equipment.

But for the most part, as just stated, it is the local business interests that are taking care of the motor camper. Oh! yes. And in two instances, which are by no means to be forgotten, the wives of the business interests have taken a hand. Women's clubs at Taylor, N. D., and Freewater, Ore., maintain camp sites which offer at least the usual facilities plus the unusual attraction of feminine sponsorship.

Automobile clubs, in a few instances, are doing splendid promotional work along these lines. The Chicago Motor Club, which maintains the camp near Washington Park, in the Windy City, offers a sterling example. The New Jersey Automobile & Motor Club, with the only camp of its kind in its state and one of the few in the eastern seaboard, likewise deserves commendation. The Tri-State Auto Club, Walla Walla, Wash.; Dickinson (N.

D.) Auto Club; Dallas Automobile Club, of Dallas, Tex.; Lincoln Automobile Club, Lincoln, Neb.; and Casper Motor Club, Casper, Wyo., may be mentioned in passing.

Motor Clubs Have Provided for Public Comfort

There are a few cases in which automobile clubs with unusual vision have established public comfort stations at intervals along the main automobile routes, as well as wayside telephones. These are projects a little outside the motor camp field, but bordering closely upon it. Considering the extent to which touring has grown and promises to grow, they are far from unimportant.

In fact, the public comfort station represents merely a very proper move in the direction of general sanitation. In many communities it should be considered a very necessary move. Provision of wayside receptacles for waste and designation of free parking spaces are other ways of recognizing the necessities that go with long-distance motoring for a large percentage of those who motor. This should be the basis of the public service idea, as applied to the highways. It is an idea that has not yet taken root, except in a relatively few instances. When it begins to spread it will be possible to provide and enforce rules of cleanliness and decency along the road. It is impossible to contemplate the growth of the touring and camping movement without foreseeing that something of this sort must come. Provisions and regulations of this sort are really the basis of recognition of the public need.

Development of the more elaborate camp sites, with all their conveniences, facilities and even comforts, shows what can be done in giving a commercial twist to the movement. This reaches its height where there are natural attractions, as at Endless Caverns, New Market, Va., Crystal Cave, S. D., and at a number of other points, where the automobile camp is part of a concession It approaches its height, if not quite reaching it, at Santa Barbara, Cal., and several other localities, where modest little bungalows are for rent at no more than a dollar a day, and where the effort is made to convert the transient camper into a permanent vacationist.

There is a great distinction between abrogating a public nuisance, which may become a menace to health, and cultivating the new form of travel for purely business reasons. The distinction between cultivating the motor tourist and mulcting him, as so many hotels and road houses have done and still do, is more obvious and in a manner of speaking, less important. The essential point to be considered is that the American public, once it is on its way, is not to be denied. And as a tourist, the American public is certainly well on its way and going strong.

Closed Car Space Taken

Virtually all space available in Grand Central Palace has been sold for the closed car show of the Automobile Merchants Association of New York, which will be held Sept. 23 to 30. This is the first time the metropolitan dealers have attempted anything so elaborate as a closed car show in the Palace, scene of the mid-winter show conducted by the N. A. C. C.

Detroit Workers Increase

Members of the Detroit Employers Association report the addition of 200 men to their payrolls the second week of July. The total now is 181,560, compared with 108,000 in the same week of 1921 and a total of 186,000 in the same week of 1920.

"Engine" Versus "Motor"

In 1916 the Society of Automotive Engineers prepared a list of standard names for the common automobile parts, in order to eliminate confusion.

The standard nomenclature was approved by the society members and resulted in saving a surprising amount of time and money in the definite and prompt making and filling of orders for parts. Certain names, the use of which was recommended in the nomenclature were, however, not adopted as generally as might be desired, probably the most important of these being the term "engine" for designating an internal combustion unit of the most prevalent type of automobile, the word "motor" being used to a certain extent instead.

"Motor" is the correct name for an electric unit used for changing electrical into mechanical energy, and its meaning as applied to internal combustion engines can be understood only by the context. An electric motor is commonly used on gasoline automobiles in connection with the starting apparatus.

The continued misuse of the word "motor" is probably due to two factors. It is used, and correctly, to designate a moving vehicle. In addition, many companies building engines were organized in the early years of the industry and included the word "motor" in their official names. As the companies prospered, the names became valuable assets and a change has been considered unwise from a business standpoint.

Nomenclature is, in a last analysis, determined by usage. Many words are common today which are in a derivative sense, entirely illogical, as well as entirely different in meaning from what they meant originally. "Electric motor" and not "electric engine" is, of course, the name for the electric unit; and the term "steam motor" is not used as applying to a prime-mover. "Engine trucks" and "engine vehicles" would be equally anomalous.

There seems to be little doubt of the logic and consistency of the use of the word "engine" to denote the internal combustion or "gas" unit of motor vehicles.—S. A. E. Bulletin.

Body Builders' Second Annual Show

The Second National Automobile Body Builders' Show will be held in New York city Jan. 8 to 13, 1923, under the auspices of the Automobile Body Builders' Assn. More than 75,000 admission tickets will be distributed and it is expected that a greater number of exhibitors will take part this year than last.

Dump and other heavy duty bodies, omnibuses, sightseeing busses, ambulances, light commercial, closed and open passenger bodies and materials and parts entering into body construction, trimming and finishing, will be included in the exhibit. The large bodies will be shown in one section, the lighter in another and the passenger bodies in a third. The parts exhibits will be placed on three sides of the 12th Regiment Armory, in which the show will be held.

It is reported that 96 percent of those who exhibited in 1922 have voted to show their lines again in addition to newcomers. Several changes have been made in the 1922 plans to conform to the suggestions of those who took part. Reviving financial and business conditions, it is believed, will make for more than the usual success the show might be expected to accomplish.

New Cabriole Combines Utility, Refinement and Economy

Many Desirable Features Make New Medium-Sized Enclosed Car on Moderate-Priced Chassis a Strong Bidder for Popularity—Details of New Earl Models

ENCLOSED body demand has been the outstanding feature of the automobile situation of 1922. Each year a larger and larger percentage of the cars made and sold is of the enclosed body form, but this year in particular, the demand has far outrun the expectations, as well as the supply, and closed cars are consequently in great demand.

With the thought in mind that this great public trend toward the enclosed body predicates a splendid business in all enclosed models, President Earl of Earl Motors has brought out a new model, the latest addition to the Earl line, and it is an enclosed model. Right along this company has offered the customary sedan and brougham bodies, but the newcomer is somewhat different, and is called the cabriole. It is patterned after the brougham and retains all the refinements and comforts of that form but through careful planning and quantity production is offered at a much lower price.

The full side view shown in Fig. 1 gives a good idea of its general appearance, while the detail sketches of Figs. 2 to 4 present some of the refinements which are sure to make it popular. Among the features which will appeal strongly to a buying public are the lightweight which makes for economy of operation, the low but comfortable springing and the small but adequate height of the body which economizes on weight without affecting comfort, convenient arrangement of seats with the right-hand, one folding forward for convenience in entering, the arrangement of the controls, the large rear fuel tank giving provision for long tours, as does also the trunk for which provision is made, and others items.

The cabriole is essentially an all-weather car. In summer, it is as airy as any touring car, as the plate glass rear quarter windows can be lowered, and the door windows manipulated instantly. The windshield is of the standard one-piece construction, and swings either in or out, thereby affording ample ventilation. The especially designed rain and sun visor, which is standard equipment, gives the much-needed protection from rain and sun.

The upholstery is of genuine spanish leather, in a rich grey tone, and the interior finish is of the same material. Other standard equipment includes dome light, windshield wiper, and complete set of tools.

The top and sides of the rear tonneau are covered with black duratex fabric, which is weatherproof, easily cleaned and very smart appearing in contrast with the painted body panels. The body color is a beautiful special blue, which gives the cabriole an air of real distinction. The fenders and chassis are glossy black enameled.

At the rear is a platform for a trunk, protected with maple slats in natural finish. The rear body panel is also protected by nickeled slat irons; and at slight extra cost, a trunk is furnished. The trunk contains two large suitcases and a hat box—a great convenience for week-end trips. Besides the trunk, special equipment includes Boyce motormeter, and front bumper, these three items being furnished at a modest extra cost.

The cabriole, weighing only 2,780 pounds, and being roomy and comfortable, will go as far afield as any touring car. Riding comfort, of course, is one of the first considerations in such a car, and is provided for in the cabriole by ample body dimensions and a low center of gravity. The extra long 56-inch rear springs too, and the rigid frame, with 7-inch side channels, and five cross members, form a foundation for the comfort of the deep seat cushions with their high grade spiral springs.

The cabriole is 1 in. less than 14 ft. in length overall; and while the height is only 6 ft. 2 in., the head room inside is ample, 37 in. from seat cushion to top lining. There is also ample leg room in the front tonneou—53 in. being the inside length.

For convenience in entering, the front seats tilt forward, and the backs fold down. This arrangement with the front seats facing forward, gives a roominess that is not possible in the average four-passenger coupe with the

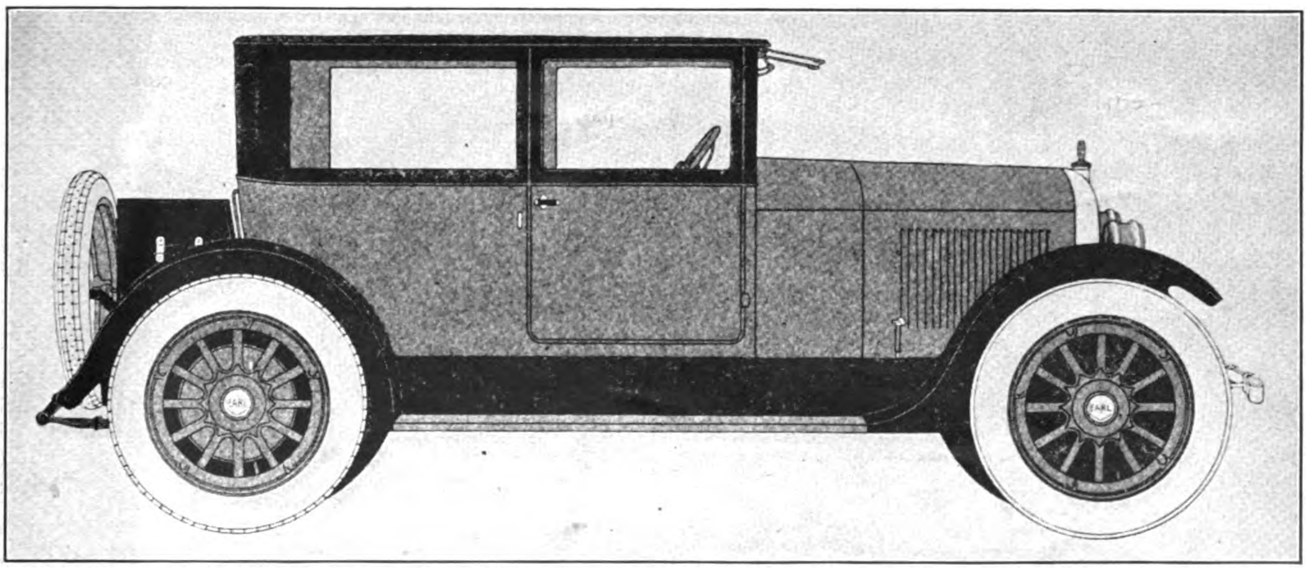


Fig. 1. Full side view of the new Earl Cabriole, giving a good idea of the body lines.

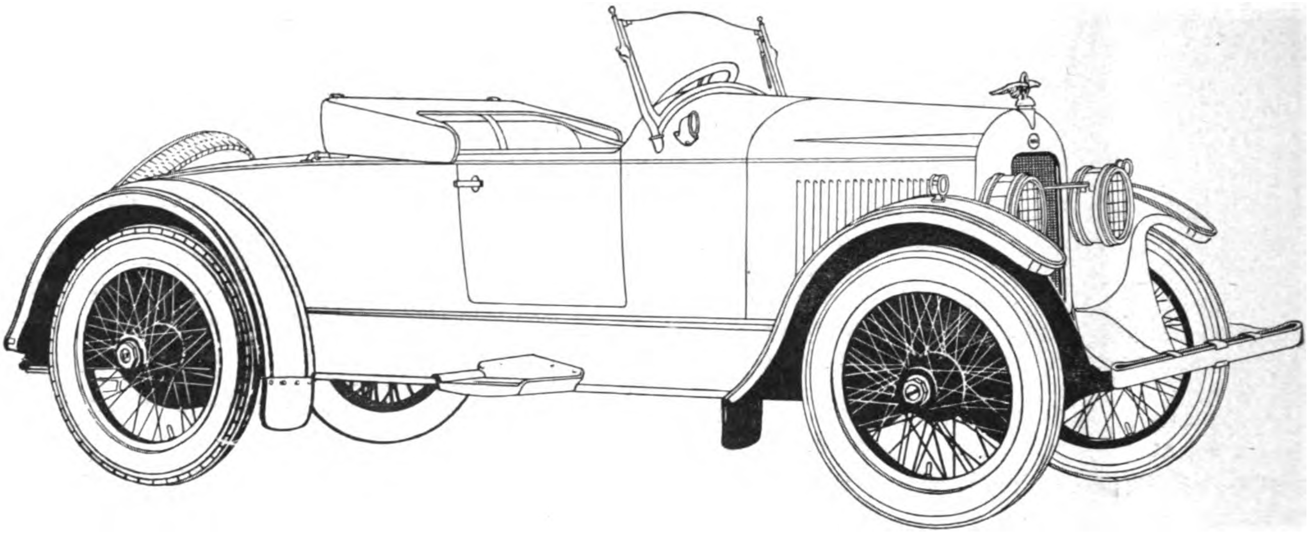


Fig. 5. Smart new roadster which has been added to Earl line.

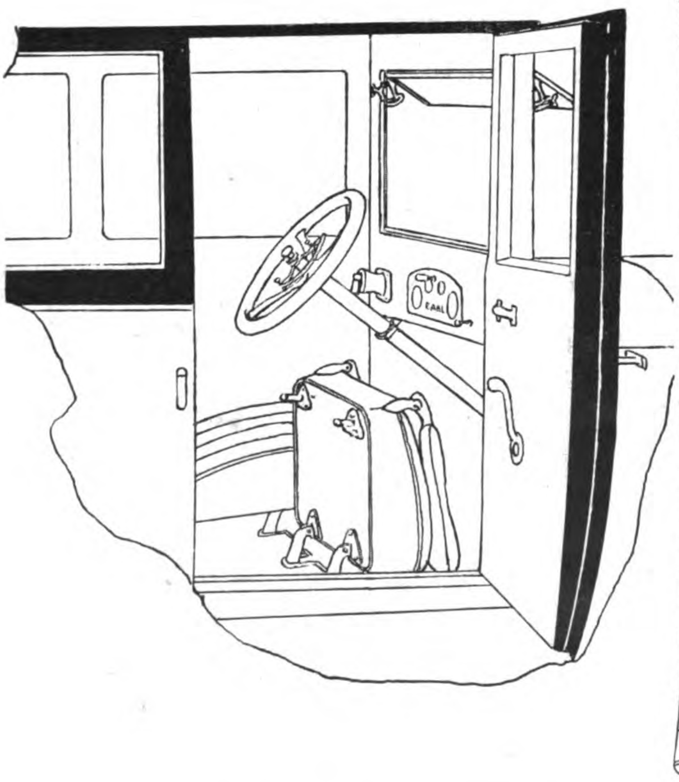
driver's seat set forward and the small swinging seat at the right, facing the rear. The front seats, themselves, are 18 in. wide, 18 in. deep and 12 in. from the floor, with a comfortable 3 in. pitch. The rear seat, which is 45½ in. wide, will seat three persons without crowding. This cushion is 18 in. deep, 14 in. from the floor, with a pitch of 4 in.

The little sketches shown here illustrate some of the special features of the Earl cabriole and will show something of the high standards set by its manufacturers in their effort to give the public a really highclass closed car at moderate cost. The cabriole will be equally at home on the boulevards, for the theatre, at the country club and on the open road; and for the doctor, professional or business man, it will provide a means of transportation that for ease of handling, economy of operation, and dignity of appearance, will leave nothing to be desired.

In addition the company has brought out a smart new roadster which costs more than the touring car, $1,485, and violates other precedents of its price class by giving its prospective owner three choices in the matter of paint and upholstery.

They are smart combinations, horizon blue with vivid blue and black striping, mustard with blue striping and Earl gray with blue striping and black wire or disc wheels —the latter likely to appeal especially to the man or woman who wants a distinctive personal car yet leans toward quiet harmony rather than an arresting color scheme.

Seat cushions, door and body panels are all in genuine leather harmonizing with the body paint. Radiator, lamps, the marine-type ventilators on the cowl, windshield frame and standards and like fittings are in polished nickel.



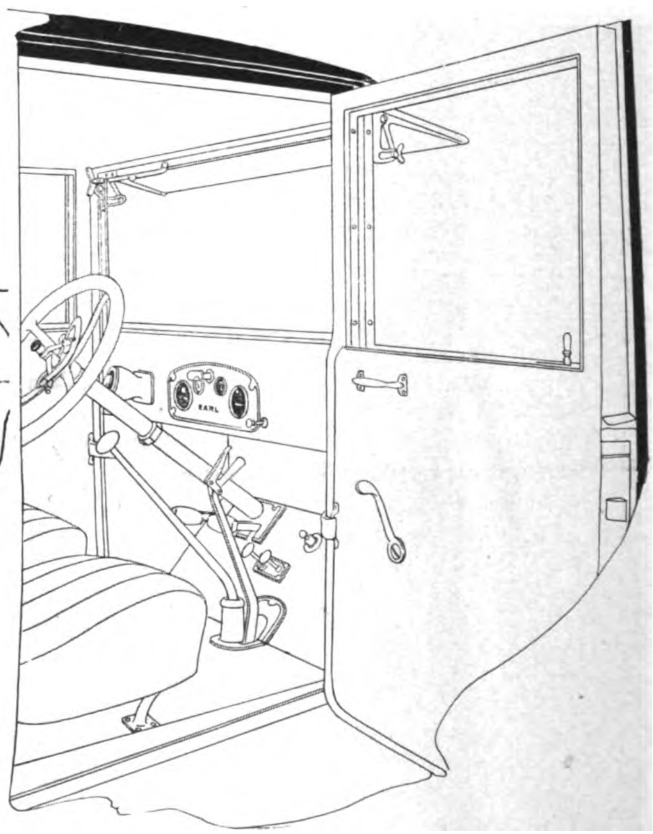


Fig. 2 (left). The right-hand front seat folds out of the way for entrance of exit. Fig. 3 (right). The driver's comment with right seat in place.

The individual steps are of polished aluminum with rubber inserts; the instrument board and steering wheel are black walnut. An interesting feature is the left-hand ignition and dimmer switch, which makes night driving easier on the main traveled roads. Five wire or disc wheels with cord tires are regular equipment. Appointments are exceptionally complete.

The custom roadster is powered by the responsive, long-stroke Earl motor; inside the frame the chassis is the

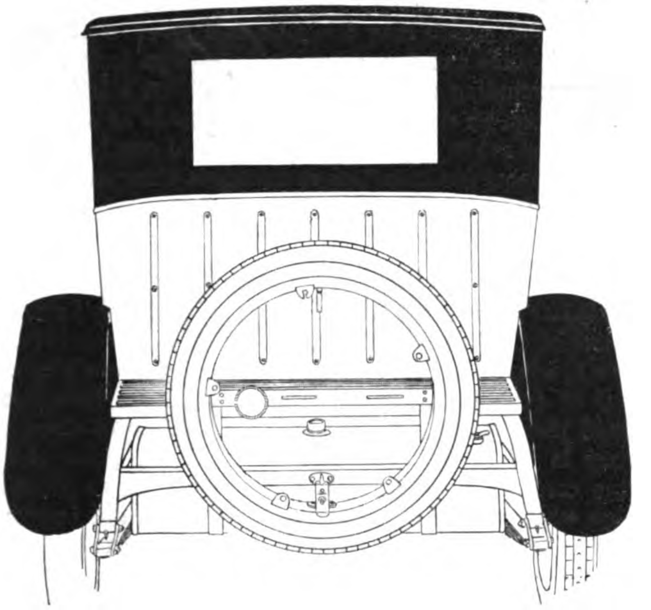


Fig. 4. Rear view of new Earl Cabriole, showing fuel tank, bumper and other details.

standard product. Its over-all length is 14 ft. less 1 in. It strikes a happy balance between spacious comfort, utmost driving ease and notable economy. Ready for the road, the car weighs 2,460 pounds.

The driving compartment is 56 in. long. The width of the seat is 42 in., the depth is 18½ in. above the floor boards. From seat cushion to steering wheel is 8 in., from back cushion 15 in. Side rails are 10 in. above seat. Luggage space at back, 20 cu. ft., gives ample room for golf bags and week-end kits, accessible by tilting the back of seat forward, making compartment dust and waterproof. Doors are extremely wide for easy entering.

New Electric Auto on the Japanese Market

A new type of electric cycle car has been placed on the Japanese market. This car, which is assembled in Osaka from parts mostly manufactured in Germany, although some parts of the body are made in Japan, is covered by German and Japanese patents and is produced at present in one-seater models. The motor is one-half horsepower electric engine of a reversible type and may be charged by the ordinary electric current through a transformer. It would appear that the advantages of small size and economical operation would render a car of this kind very popular, but as yet none of them have been seen on the streets.

More motor trucks are used on the farms in the west north central states than in any other section of the country, according to U. S. Bureau of the census figures. Minnesota, the Dakotas, Iowa, Missouri, Kansas and Nebraska have 33,000 trucks on farms.

Packard's New System of Bonuses

The Packard Motor Car Co. has inaugurated a new system of bonuses for its employes as a reward for accuracy and pride of workmanship and to stimulate production, that is bringing about all the results sought. The new plan, instead of awarding a bonus to the individual worker, adds a certain percent to the pay envelope of every man in a department when the record of that department's output shows an increase.

Thus, for each 1 percent in increased efficiency in the department, 1 percent is added to the salary of each worker in that division. It has been found that inasmuch as any greater efficiency displayed by an individual tends to raise the combined standard of all the emoloyes in a department, the new bonus system creates a spirit of co-operation which, it may be, could be obtained in no other way. The saving in accounting, when the new system is compared with the individual bonus plan, is at once obvious.

"Each worker in a department has a personal interest in the entire work of his department," the company finds. "Laxness, loafing or carelessness in workmanship for that reason are frowned upon by the men themselves. A laggard workman is considered by his fellows to be an obstacle in the path to a bonus and they themselves insist that he do his part or get out.

"The first department in which the new plan was tried increased its efficiency 4 percent in the first two weeks. Stimulated by the increased pay which resulted, the department increased its efforts still further until in the last two weeks the increase amounted to 19 percent, with a resulting 19 percent increase in pay.

"In this department a common laborer had been employed as a trucker. It has been his habit to sit down and rest while waiting for a load for his truck. One of the skilled workers explained the bonus plan to him and pointed out what it meant to him personally to utilize every minute of his working time. As a result the skilled worker became a teacher with an eager pupil and the trucker has taken a step up in his work and has doubled his wages."

Third Largest Single Month's Output of Cars

Shipping reports to the National Automobile Chamber of Commerce, 90 percent complete, indicate that July shipments from all factories will reach a total of 28,412 carloads, 28,022 driveaways and 6,885 boat.

On this basis it is estimated that 246,600 passenger cars and trucks were produced by all makers in July, exceeding July, 1921, by 39 percent and the best previous July (in 1920) by 20 percent. The decrease under June, of 14 percent, is seasonal, and expected. This is a record for production in July and is the third largest single month's production in the history of the industry, being exceeded only by the two preceding months. The factory shipping figures for all manufacturers are:

	Carloads		Driveaways		Boat	
	1922	1921	1922	1921	1922	1921
January	15,357	6,485	7,479	3,185	143	93
February	19,636	9,986	10,173	7,507	180	99
March	27,753	16,287	16,917	9,939	560	75
April	31,334	20,187	22,381	14,197	2,960	1,619
May	33,416	18,608	28,827	15,193	7,406	2,381
June	34,230	20,269	33,857	18,834	7,737	3,947
July	*28,412	19,514	*28,022	15,533	*6,855	3,726

* July, 1922, partly estimated.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIV AUGUST, 1922 No. 5

Front Brakes Coming

USUALLY the manufacturer who goes in for racing claims that he does it for the benefits in the way of ideas for his regular product obtained and proven out in this way. If we grant then, that racing brings forth a number of new ideas and proves them out so that they can be adopted (or rejected) for use on standard touring vehicles, the tendency seems to be all toward fewer and fewer cylinders, smaller bores, much higher crankshaft speeds, and above all, four-wheel brakes of very large dimensions.

Leaving aside the other topics for later discussion, it would appear that the four-wheel brake is rapidly becoming standard racing equipment. Similarly, many of the best foreign car designs show the addition of the front wheel brakes. All those which have ever done this are still using it, and its adherents grow with each new announcement of designs or models. The few cars in this country which have adopted front brakes have been remarkable successes.

From another standpoint, they are almost a necessity. The density and speed of modern city traffic demands very powerful brakes, perhaps more powerful than is possible using the rear wheels alone. This thought, of limitation of space and size, perhaps explains the number of recent adoptions of shaft brakes, after these had apparently fallen into public disfavor.

Whatever the traffic laws of the modern city may say about slowing down to 12 or 15 miles an hour or some such figure, every traffic policeman, every driver, everyone directly concerned knows that in reality the traffic moves at double or triple those figures between stops. If one doubts this statement he has only to time the vehicles on, say Fifth avenue or Michigan boulevard or other crowded thoroughfares between traffic stops. Such speeds as these and then sudden stoppage call for the most powerful and efficient of brakes.

The much higher speeds at which modern vehicles can travel with absolute safety make certain that these speeds are used out in the open country when the road is fairly clear. Knowing that his car has very powerful and efficient brakes what driver will hesitate on a long trip to "step on her" when the road clears of city traffic and is hard and fast as far ahead as the eye can reach? Just the same, two tons or more of metal and people traveling at high rates of speed, such as 45 or 55 miles an hour along the best of country highway requires a whole lot of efficient brake surface to bring it to a stop, to say nothing of a sudden stop if such should become necessary.

All of which is simply further argument for the front wheel brake, which may fairly be said to have proven its worth in home and foreign races, in foreign long distance touring including much mountain work, on a few cars in this country, on wet or greasy road surfaces as a skid preventer, and otherwise. Why then, should our better class manufacturers hesitate longer to adopt this undoubtedly beneficial feature?

Price Rearrangements Not Concluded

FOLLOWING the few price cuts of early July, the last of the month saw more, and the early part of August a considerable number of reductions, until now a total of perhaps 15 or 16 prominent makers have readjusted their prices to new low levels. Many of these are lower in actual dollars and cents than the price of the same cars before the war, to say nothing of, to place no value whatever on, the many and most desirable improvements which have been made in the intervening eight years.

There are still a number of makers whose prices are out of line or who have not yet sensed the trend of the times, who will be forced by competition to reduce later. The number of these is greater by comparison than is their output in proportion to the total output. That is to say they are the smaller makers with a more limited output. But the fact remains that they will be forced to reduce later. This means that we will have a number of straggling reductions all through the fall and winter seasons, with their disturbing influences.

It would have been wiser, better for all concerned, if all these could have been arranged for one time, all reductions made at once, and then no more changes for at least a full season. It would have convinced the public that the bottom had been reached, which in turn would have stimulated business in a normally dull season, and the savings made in this way would have accounted for the whole of the reduction if carefully made.

It would seem, considering the happenings of the last two years, as though the manufacturers of cars should get together on this question of price reductions (or increases), to their mutual benefit, just as they have done on standardization, patents, legislation, transportation (via railroad), and many other similar matters. In fact, it would seem that the matter of prices is even more important, more worthy of adjustment in conference than most (or all) of these other matters on which the manufacturers have been able to get together.

Benz Merges in Europe

Advices from Frankfort-on-the-Main, Germany, are to the effect that the Benz Automobile Works of Mannheim have merged with the Phoenix Steel Works of Frankfort. The Phoenix plant is one of the most important establishments of its kind in Germany.

Gasoline Recovered from Still Vapors

BY D. B. DOW*

Collection of Vapors After Passing Condensers Permit Removal of Valuable Motor Fuels. Proper Places to Install Traps. Valve Arrangements

SEEKING all the possible motor fuel recovery from the crude oil, for the motor fuels yield the highest market price of any product or by-product, oil men have found it possible to save in many small ways with a total which is quite considerable. In distilling crude petroleum the first vapors driven off are naturally the lightest hydrocarbons and have the highest vapor pressure of any hydrocarbons present in the crude oil. In order to condense these vapors it is necessary to have condenser coils with large surface area held at low temperatures.

Under these conditions all the vapors would condense except the very lightest, which would more correctly be called permanent gas than gasoline vapor. The small amount of gas left uncondensed would under these conditions be almost entirely dissolved in the condensate. Ordinarily, however, the temperatures of the condenser boxes are high enough so that a large part of the first few percent distilled remains uncondensed. By removing these vapors as rapidly as they are formed, and by submitting them to subsequent compression and cooling, or by dissolving them in a low gravity oil, a large part of such vapor can be recovered as gasoline.

Collection of Vapors

After passing through the condensers, the vapors can be removed from the rundown lines at any point. Sometimes they are taken from the bottom of the coil by a riser passing upward through the water in the condenser box. This arrangement is less desirable than taking the gas off outside the condenser box, as the latter method cuts down repair costs. More frequently, they are removed at the "tail-house." A gooseneck or trap is usually placed between the gas gathering line and the "lookbox." This prevents air from being drawn into the line from leaks in the "look-box." A small vapor line is also frequently seen leading from the lookbox to the gathering line, but in most cases, it discharges into the air, since the amount of gas led off from this point is very small and would be largely diluted with air leaking into the look-box.

The risers from the bottom of the worm, or from the goose-neck vary in diameter, depending on the volume of gas to be handled, generally from 1¼ to 3 in. In a large plant with several tail houses, the small risers enter a larger line, which in turn, discharges into a still larger main line leading through the trap to the gas plant.

A vacuum held on these lines is so regulated that the vapors are removed as rapidly as formed. In the different plants visited, this vacuum varies from 1-2 to 6 in. of water. As regards best general operation, 1 in. would probably be sufficient, since higher vacuums cause a considerable amount of condensate to be re-evaporated and may also produce a vacuum on the still, which is to be avoided. Great difficulty is experienced with higher vacuum from leakage of air into the lines. In some refineries vacuum valves are used and in case the vacuum becomes too high on any unit, these valves open and permit air to enter. On other plants, instead of this valve a small "clapper" valve is situated at the top of each header. This serves the opposite purpose, for should the pressure of the still exceed the vapor capacity of the vacuum line, the value permits the excess vapor to escape.

A simple and efficient device to avoid excess pressure from the still is a 2 in. pipe which extends from a tee at the top of the gas riser to about 2 in. below the water surface in the condenser. If the pressure in the gas line becomes more than 2 in. of water, gas will escape through this pipe and relieve the pressure. The pipe should be long enough so that any excess vacuum will not draw water into the gas line.

A combination of these valves is desirable, so that the still will never be under any pressure or vacuum resulting from the gas system.

Traps on Gathering Lines

In building a recovery system for uncondensed still vapors, it is well to install traps between the exhauster or intake of the compresser and the source of the gas. These traps serve several purposes: they remove condensate caused by air cooling or any heavy products carried over mechanically which would destroy lubrication in the exhauster or compressor; they act as a pressure equalizer, so that no sharp changes of pressure will take place on the run-down lines; and they serve to remove sulphur.

In the different refineries visited the traps were practically of the same type, consisting of a steel tank varying in size from about 4 ft. in diameter by 5 ft. high, to 15 ft. in diameter by 18 ft. high. In these traps the gas receives a preliminary washing with water, which removes sulphur, condensate, and heavy hydrocarbons, carried over mechanically.

Various methods of washing are used, from a simple gas inlet below the water level, to a small perforated water pipe placed inside the gas inlet pipe, which sprays the gas before it passes through the water seal.

In some plants traps are placed at every "tail-house" and in others only one large trap at the exhauster house. In one refinery visited where a trap is installed at each unit, a steel tank 15 by 18 ft. is used. A 12 in. gas intake line enters the top and drops to within 3 ft. of the bottom where the gas bubbles upward through the water, after being washed by a spray. The washed gas rises and leaves the trap by a line from the top where it goes directly to an exhauster.

The trap previously described has a relief valve which vents gas into the air whenever pressure builds up on the lines and thus prevents trouble at the still. A butterfly valve is regulated from time to time to hold the same vacuum on the run-down lines. Regulating devices of this sort are necessary, since the volume of gas given off from the condenser coils varies through wide ranges, and in case the vacuum carried on the trap is not sufficient to handle the vapors as rapidly as they are formed, back pressure is built up on the still. This condition should be

* Engineer, U. S. Bureau of Mines.

avoided. The amount of gas formed varies with changing conditions, such as temperature of water, difference in crude, etc. If the vacuum carried on the lines is so high that the gas formed is not sufficient to compensate, a vacuum would be exerted directly on the still. This condition should also be avoided. There should be just enough vacuum on the lines to take care of the vapors, no more, no less. This will always give the same conditions of pressure as if the uncondensed vapors were passing directly into the air.

In some plants, the condensate formed in these traps is washed into the sewer, but in other plants it is recovered from the surface of the water.

Use of Exhausters for Gathering Vapors

The recovery systems installed in complete refineries are necessarily much larger and more complicated than in skimming plants, since the wide separation of sources of gas makes it difficult to carry the same vacuum on all rundown lines. Skimming plants with a crude charging capacity fully as large or larger than complete refineries have a smaller number of stills, and this results in shorter and less complicated gathering lines. In a plant of this character an exhauster is not necessary, as the vacuum needed for gathering the vapors can be developed by the intake of the compressor.

In complete refineries, however, where various types of stills are all being used, the area of the plant is much larger, the gases formed differ widely in composition and volume, the pressures vary over wide limits and the gathering lines are more complex and much longer. Hence in this type of refinery, installations must be made which will gather all of these different gases without allowing pressure to build on any still that is making a large amount of gas, or without producing a vacuum on a still that is making very little gas.

Positive pressure, rotary blowers or exhausters are used for gathering uncondensed vapors, since they fill the requirements better than any one other type of compressor or blower. They can handle large volumes of gas, hold a vacuum on the run-down lines of one to four inches of water, and discharge at a pressure high enough to force the gas through the sulphur scrubbers. A reciprocating machine is not so practical for this work, since a machine capable of handling large quantities of gas at the low pressures would be so large that the installation and operation would be prohibitive. In such a machine the surface friction of the gas due to the high velocities through the valves and ports, for large volumes at low pressure becomes very high, as compared with its large inlet and discharge openings and attending low velocity. The mechanical friction in the rotary machine is very low, since it is confined to slow speed journals and gears which run in oil. In the piston machine the mechanical friction is much higher, because there is considerable friction in the piston and rod packing, journals, valve gear, and sliding parts.

The fan or turbo machine, which might be used, has the disadvantage of loss of mechanical friction by journals running at high speeds, and leakage loss due to the fan not fitting the shell. Corrosion of the thin steel blades also gives continuous trouble. These disadvantages are all eliminated in the rotary blower which results not only in better and cheaper operation, but also eliminates shut-downs for repairs. Due to these advantages, the rotary exhauster requires very little attention.

Lubrication of Exhausters

In one refinery visited, two exhausters are used, which have a daily capacity of 2,500,000 cubic feet of gas. These exhausters have been used for several years and after a series of operating tests employing different methods of lubrication, it was found that the best results were obtained by feeding a half gallon of 50-54 naphtha into the exhauster in a half hour, followed by feeding lubricating oils for about 5½ hours. This operation is then repeated, with the result that in 24 hours runs two gallons of the naphtha and two quarts of lubricating oil are used.

With this method of lubrication no trouble is ever experienced. In eight years' time there has been only one forced shut-down, which was due to an accumulation of sulphur. It is now the practice to take the blowers apart once a year and clean out any sulphur that may have been deposited.

The Presence of Sulphur in Petroleum

While plants do not provide for removal of sulphur from uncondensed still vapors, this is a very important factor in refineries where vapors from cracking stills are treated.

This problem also depends upon the nature of the crude, since the sulphur content varies widely in different crudes. Mexican crude in some cases runs as high as 5 percent sulphur, California crudes 0.34 to 3.55 percent, Gulf Coast crudes about 1.75 percent, Oklahoma and North Texas crudes about 0.4 percent (except that from Healdton, which has 0.76 percent), Pennsylvania crude about 0.06 percent; Lima, O., crude 0.65 percent, and Canadian crude as high as 1.00 percent.

The sulphur is present in the crude, partly as free sulphur and partly combined with hydrocarbons which, according to Mabery (Chas. F. Mabery, "Elements That Control Petroleum." Oil and Gas Journal, Sept. 10, 1920, p. 68), have the general empirical formula of $C_nH_{2n}S$. The compound $C_{10}H_{20}S$ is representative of this class. These compounds are "unstable when heated in contact with air, but distilled without decomposition in vacuum. This structure is uncertain but probably cyclic with sulphur the connecting link."

Decomposition of Sulphur Compounds

The temperatures and pressures commonly employed in stills do not break down the sulphur compounds in the crude to the point where much free sulphur is deposited in the vapor lines to the gas house. Generally, the sulphur compounds are largely dissolved in the distillate and are removed by chemical treatment, and any sulphur compounds that remain in the vapors are not ordinarily considered of enough importance to warrant the installation of scrubbers. However, in refineries using pressure stills or running crudes rather high in sulphur, the temperatures and pressures are such that these organic sulphur compounds are more completely broken down. This results probably in the formation of hydrogen sulphide, which in turn, is readily oxidized to sulphur and water, and also breaks down at high temperatures to form hydrogen and free sulphur. That the decomposition of sulphur compounds takes place is evidenced by the deposits of free sulphur on look-boxes and the presence of sulphur dust in the gas system, which if not removed, fills up the lines, blowers and valves of the gas plant. In one instance a 2 in. castiron tee had been as completely filled with sulphur as if it had been melted and poured into the tee.

As stated before, the amount of sulphur depends upon

the crude being refined and in several refineries where varying amounts of Mexican crude are used the sulphur content of the uncondensed vapors varies between 600 and 3,000 grains per 100 cubic feet of gas.

Several methods have been used for the removal of sulphur from uncondensed still vapors. Probably the most extensively used process is that of scrubbing the gas with a lye solution after the gas is discharged from the exhauster.

In this method the gas is passed countercurrent through a series of scrubbers filled with wooden baffles. It is first scrubbed with water, which removes the free sulphur and dissolves some of the hydrogen sulphide. The gas then passes into a lye scrubber where a solution of lye (caustic soda) made up of 15 deg. B. (1.1115 sp. gr.) removes the hydrogen sulphide, and other sulphur compounds. The gas then passes through a last water scrubber which removes any alkali that might have been carried over from the lye scrubbers.

A plant on the Atlantic seaboard which uses this system has six tower scrubbers 20 ft. high and 4 ft. in diamter connected in series. These scrubbers are filled with wooden baffling made of 1 in. by 6 in. boards and supported by an angle iron riveted inside the tower. The gas inlet is 2 ft. from the bottom and the outlet 4 in. from the top. The gas entering the first scrubber, passes up countercurrent to warm salt water. The water is about 5 deg. warmer than the gas, being pumped directly from condensers. The higher temperature of the water serves to keep any of the gasoline in the vapor from being condensed. The salinity of this water has no advantage, but only sea water is available in unlimited quantities. In fact, the salts in the water are very corrosive and are detrimental to the steel in the towers.

The gas passes through four of these water scrubbers and then into a lye scrubber. In the sixth and last scrubber the gas receives a final washing with warm sea water to remove any lye carried over mechanically. The water and lye are circulated by duplex pumps, the lye being recirculated until the absorbing efficiency is lowered to the point where fresh lye is required. The source of the crude again becomes a factor, since, according to the men operating the plans, lye does not absorb sulphur from the vapors of Mexican crude as readily as it does from mid-continent crude.

Chemicals Required

In this plant 12 600-lb. drums of sodium of hydroxide (lye) made up with water 15 deg. B. treats 1,500,000 cu. ft. of vapor a day and will last from three to four weeks, the crude refined being 20 percent Mexican of 22 deg. B., 60 percent mid-continent of 33.4 deg. B., and 20 percent Pennsylvania crude of 41.5 deg. B. A fresh solution of lye lowers the sulphur content from about 3,000 grains per 100 cu. ft. of gas to about 60 grains per 100 cu. ft., but this efficiency drops rather rapidly. Blowing the lye with air revivifies the charge and the life of the solution can thus be made much longer. In order to determine the efficiency of the lye treatment, a test was made at this plant on gas with very high sulphur content, using fresh lye of 13 deg. B.

The cost of this treatment is not excessive, the price of sodium hydroxide being in the neighborhood of $6 per 100 lb. The spent lye is wasted into the sewers.

A second method of removing sulphur from the gas is by the use of iron oxide. This method is not employed as extensively as the lye method, but due to certain advantages is coming into more general use. It consists of scrubbing the gas with iron oxide suspended in water. The iron oxide removes the sulphur from the gas and is changed to an iron sulphide. The oxide is held in suspension in the water by agitation with air. The air also serves in revivifying the suspension by furnishing oxygen for the conversion of iron sulphiles to iron oxides.

Methods of Recovering Gasoline from Uncondensed Still Vapors

The uncondensed still vapors may be treated for the recovery of the gasoline present in several ways: by compression and cooling, which condenses the gasoline as a liquid; by absorption, where the vapors are brought into intimate contact with an absorbing oil and the heavier hydrocarbons are selectively absorbed from the lighter ones present (permanent gases); or by a combination of the two methods, which consists of an absorption system on the residual gas from a compression plant.

Recovery of Gasoline by Compression and Absorption

Uncondensed still vapors contain a large percentage of gasoline vapor, and the boiling point of this gasoline may be much higher than atmospheric temperature. The molecular movement in a liquid depends on its temperature and with any molecular movement, a definite amount of evaporation takes place. If the evaporation of gasoline were taking place in a closed vessel, it would continue until the pressure exerted by the gas above the liquid was just sufficient to balance the vapor tension of the liquid, that is, the tendency of the liquid to vaporize. Under these conditions, a state of equilibrium is said to exist. If this vapor and liquid were cooled a few degrees (the pressure remaining constant), or, if the vapor were held at the same temperature and more pressure applied, some of the vapor would condense to restore the equilibrium. With these principles in mind, it will be seen that a large percentage of gasoline vapor and then removing the heat which was formed by compression (by means of some cooling agent—in this case water) an equilibrium must be reached, which can only be done by condensation of the gasoline. This process is so regulated by experiment that the pressures and temperatures are such that the gasoline condensed without the precipitation of some of the very volatile hydrocarbons of such low boiling point and high vapor pressures that they cannot be held as gasoline when the pressure is relieved. It is well to mention, however, that no close separation can be made and that in this system of recovering gasoline some of the vapors remain uncondensed, and also that some of the lighter hydrocarbons are obtained, either by condensation or as gases dissolved in the gasoline produced.

The absorption process depends on solubilities of light hydrocarbon vapors in heavier oils. The solubilities depend very largely on the vapor pressures of the light fractions of the absorbing oil; for example a very much smaller percentage of methane than penthane will dissolve in a given oil. Hence, by bringing the gases from the run-down lines into intimate contact with an oil, the heavier hydrocarbons in the gas are selectively absorbed and the permanent gases pass through without being dissolved to any great extent.

In a combination of the compression and absorption methods, the discharge gas from the compression plant is washed with 50 deg. naphtha. This naphtha is then blended with the raw compression gasoline.

Preparing Automobile Bodies for Paint*

BY W. C. DuCOMB, JR.†

Unless the Work is Free from Rust and the Causes of Rust the Best Paints and Varnishes Will Not Produce Satisfactory Results

THE object of this paper is to describe how automobile bodies are prepared for painting and, what is of great importance, how the cost of this important operation can be greatly reduced in many automobile body paint departments by preventing rust in the plant where the bodies are built.

The keynote of Mr. E. J. Thompson's address, given to the Associate Members of the Automobile Body Builders Association last January was "The Elimination of Waste" and frequently the elimination of waste means profit instead of loss for a company. One way to prevent waste is for the manufacturers of steel automobile bodies to deliver to the paint shop bodies "in the white" that are free from rust so the cost of preparing these bodies for paint will be kept at a minimum.

As the cost of preventing rust is but a fraction of the cost of removing it the logical procedure is to prevent rust, this being accomplished by destroying the causes of rust before the rust appears. If rust is actually wanted, why remove it in the paint shop, and, conversely, if the rust is not wanted, why produce it in the body shop? It is, therefore, apparent, the preparation of automobile bodies for painting really should start in the body shop where paint troubles really begin to terminate and the rustless process of soldering and metal finishing has been developed for this purpose. This process will be taken up in this paper after the operations in the paint shop have been described.

Importance of Preparing Bodies for Painting

It should be noted that the first operation in painting is the preparation of the body for the prime coat. The consensus of opinion of experienced paint department heads is: The two most important operations in painting automobile bodies are preparing the work and applying the first coat, i. e., cleaning and priming the body. Given this foundation, all the other coats and operations are carried on with success, but without the work is actually free from rust and the causes of rust, the best paints and varnishes will not produce satisfactory results, and the manufacturers of these products are often called upon to "make good" when they are in no wise responsible for the poor results obtained, even by good workmen. As the paint coats afford protection for the steel, as well as to give it an attractive appearance, the importance of properly preparing both passenger car and commercial bodies for the paint is apparent. It is a decided waste of money to apply good paint to a surface to which it will not permanently adhere, which will be the case if the causes of defects in the paint coats are not removed before the paint is applied. The foregoing is equally true for aluminum and galvanized sheets, but in the case of galvanized sheets it is necessary to produce a stone-like surface to insulate the zinc coat on the metal from the oils in the paint, while in the case of both steel and aluminum, the paint must fully contact with the metal.

Methods in the Paint Shop

Two distinct methods are used to prepare steel automobile bodies for the prime coat. One is to mechanically remove rust and the other to remove rust and destroy the causes of rust by chemically processing the bodies.

The mechanical method may be to go over the entire body with abrasive paper or cloth, or by the sand blast, and these methods are still in use in some paint shops. Usually the oil is removed by an oil solvent, such as gasoline or naphtha before the rust is removed by hand labor and quantities of abrasive paper or cloth. When the work is sand blasted, a specially built room and a sand blast machine with an ample supply of compressed air to drive the grains of sand against the work must be provided. It will be noted mechanical means remove the surface of the steel so the virgin metal is exposed to the atmosphere with all its rusting tendencies. The chemical process consists of applying a rust dissolving liquid—deoxidine—to the body by flowing it on with a brush, similar to a varnish coat, but without any care other than to see the entire surface is covered with the chemical agent. A quick scrub with No. 3 steel wool insures all of the surface being processed, after which the residue of the deoxidine is washed off with water and the body thoroughly dried. Deoxidine not only dissolves rust, but removes oil and also neutralizes rust stimulators, such as soldering acids, hand marks, etc., which are certain to cause defects in the paint unless destroyed. A deoxidized surface is a rust-inhibitive condition, as the deoxidine has chemically acted on the steel to very slightly etch it and to place it in a condition to resist rust, although it does not form a coating on the metal.

Objections to the Two Methods

All rust can be removed by the sand-blast method, but unfortunately the things which cause rust are not removed, either by hand sanding or the sand blast. The rust stimulators are simply spread over the surface with the result that rust develops under the paint and defects appear in the finish, frequently before the car is delivered to the purchaser, and sometimes before the body is shipped from the paint shop. When the work is sanded by hand, the workmen's hands and arms come in contact with the steel, leaving perspiration thereon, with the result that sodium chloride, i. e., common table salt, and other objectionable chemicals come in contact with the steel to stimulate rust under the paint. A number of cases have been observed where hand marks show through 20 or more coats of paint. When bodies are sandblasted it is customary for the workmen to wear cotton gloves so their hands will not come in contact with the metal when the body is moved from the sandblast room to the spray booth where the prime coat is applied. However, the gloves become saturated with perspiration, so hand marks occur even when this precaution is taken. The hand sanding operation cost one automobile body builder $30,000

* A paper read at summer meeting of Automobile Body Builders Association, Detroit, June 21, 1922.

† Mr. DuComb is manager of the Detroit office, American Paint Company.

in two months to repaint bodies because defects developed in the finish from perspiration, as the harder the men worked to sand the surface clean the more they perspire and the greater the amount of perspiration deposited on the steel. A number of these bodies were repainted three times and some four times before satisfactory results were obtained.

The acids used in the soldering department stimulate rust to a far greater extent than perspiration and are certain to produce defects in the finish unless the residue of these acids is made inert. This can be accomplished by using the rustless process of soldering. Even when no soldering is required, the mechanical method exposes the virgin metal to the air, consequently it is in the best condition to rust both before and after the paint is applied, for paints and varnishes are not impervious to the air and moisture, the foods of rust. If the sand blast is used, an added objection to mechanical means for preparing bodies is found in that sand enters all the cracks and crevices inside the body, even gets in the door hinges, to fall out in the paint shop all through the operations, for it is actually impossible to blow out all sand with compressed air.

Probably the greatest objection to chemically processing bodies by the deoxidine patented process, is that care must be exercised to see all the residue is washed off with water after oil, rust and rust stimulators have been removed or destroyed. In other words, like paints, if deoxidine is not used as it should be, satisfactory results will not be obtained. Fortunately, it is easy to note whether all the deoxidine residue has been removed, by noting whether the surface feels clean or whether it feels sticky, and if it is sticky or tacky the surface can be quickly made clean by the use of more water. It is also fortunate that if any sticky places remain the body cannot get by the rubbing deck, for when water is applied in the rubbing operation, the paint coats will soften and can be peeled off with a putty knife where any sticky places remain under the prime coat.

As between three and four million steel automobile bodies have been prepared for painting by means of the deoxidine process without trouble, there is no question that when deoxidine is used according to instructions satisfactory results are easily obtained. It may be said the cleaning operation is a necessary evil, in fact, the head of one of the largest body builders made this remark about sand blasting, but it is a fact the deoxidine process has replaced mechanical methods in so many body plants and paint shop, that it may safely be said "it is the least of the evils." With proper inspection, it is easily possible to obtain 100 percent efficiency when deoxidine is used to prepare bodies for the prime coat.

One of the objections may be found in the fact workmen using deoxidine should be provided with white acid rubber gloves with gauntlets, and really should wear white acid rubber packs or rubber boots. However, it is necessary for the workmen on the rubbing deck to be properly equipped, so it appears this is a minor objection. It seems proper to bring out the point that until deoxidine was invented there was no way to prepare steel automobile bodies for painting so there would be no tendency for the steel to rust under the paint, so that while objections may be raised against deoxidine the great advantage of producing a rust-resisting surface to paint would seem to overshadow all objections which the extensive use of the material indicates.

As mentioned in the first part of this paper the preparation of the body for paint should begin in the body shop, for it is there the paint troubles start. It is important that the welding operation be carried on so that there is no heavy oxide produced which requires removal before solder can be applied. A welding flame can be regulated so as to either oxidize or deoxidize, and if it is a disadvantage to cause a heavy coat of oxide, it is logical to avoid doing so. The rustless process of soldering consists of substituting a self-cleaning soldering fluid, which does not fume and fill the air with a rust-causing gas, for the muriatic acid (raw acid which does fume) and a flux. It so happens this soldering fluid cleans and fluxes so well that the workmen immediately say "this is what we want." It is probable the workmen are influenced to some extent by the fact that they desire to get rid of hydrochloric acid gas, which is hard on the eyes, nose and throat and destroys their clothes and shoes to a much greater extent than the self-cleaning, non-fuming soldering fluid—flosol.

After the soldering has been completed a neutralizing solution is applied for destroying the rusting effect of the soldering fluid. The consequence is all tendency to rust is prevented and the bodies are carried through the operations in the body shop without rust at any stage with the exception of the small amount of atmospheric rust, which is greater in the spring and fall of the year than in the winter and summer. If the bodies are to be immediately delivered to the paint shop to be prepared for painting, no further attention to prevent rust is required other than to keep the work out of the rain.

Quite often bodies are built in one city and shipped to another, and are in transit for a week or even a month. By applying a coat of chemical rust-preventing oil—peroline, the bodies arrive in the paint shop entirely free from rust even though they have been in the rain for several days. The result is these bodies can be quickly processed with deoxidine at least expense. One of our customers has been using the rustless process and giving the bodies a coat of peroline before shipping to another city, for more than a year, and is only using about one-third as much deoxidine to process the bodies for the prime coat. This is a large saving, and if all body manufacturers and paint shops would "get together" to prevent rust on bodies, a saving of more than a million dollars a year in the aggregate could be effected. It should be mentioned that a number of the most progressive body builders have adopted the rustless process and several of these users have informed us a considerable saving has been effected in the metal finishing operation, because hertofore it has been necessary for the workmen to remove considerable rust prior to beginning to metal finish the work. When the metal is kept free from rusting it is much easier to inspect it so as to note where it must be filed and bumped, in order to obtain the required smooth surface.

Galvanized Sheets and Plymetl for Commercial Bodies

It is thought by many painters that paint cannot be satisfactorily applied to a galvanized surface because they have not investigated the subject. The only requirement is to prepare the surface for painting, which can be quickly and cheaply accomplished by chemically processing bodies with lithoform. Sign painters have used lithoform for a number of years and it is noteworthy that when once a painter begins to use lithoform, he will not paint galvanized work unless it has been lithorized.

Some Problems in Automobile Finishing*

MR. CHAIRMAN AND GENTLEMEN: I first wish to express my pleasure at having been invited by your president to address you—though "address" is hardly the proper word as this is not an address but a talk with men whose interests and problems are also those of the varnish industry. The number of concerns engaged in the paint and varnish industry probably exceeds half a thousand—those who manufacture materials for your industry are not over 10 percent of the total and those who direct their major efforts towards supplying the needs of the automobile body builders can be easily counted on the fingers of your two hands—perhaps on the fingers of one hand.

The problems involved in manufacturing the materials for finishing automobiles are the most highly technical and complicated of any in the whole paint and varnish field. A long book would be needed to cover in anything like adequate detail the making in a modern, scientifically conducted varnish plant of the materials you use. To give a brief insight into the manufacture of high-grade automobile varnish, I will take one of the four principal kinds of material used and follow it through from start to finish.

As you probably know, the four principal materials used are the gums, the fixed vegetable drying oils, the metallic driers and the volatile vegetable or mineral oils—the thinners. The gum gives hardness and brilliancy, the fixed oils furnish flowing qualities, elasticity and durability, the metallic driers enable the varnish, when applied, to absorb oxygen and dry—and the thinners reduce the gum—oil—drier base of the varnish to a workable consistency.

"Short Oil" and "Long Oil" Varnishes

The clear varnishes you use are of two types—the rubbing varnishes or "short oil" varnishes—so called because they contain less oil than gum, and the finishing or "long oil" varnishes, so called because they contain more oil than gum. Of these two types, the latter is far more difficult to manufacture and in their make-up the oil is the most important material. In the free-flowing elastic type of finishing varnish used on automobile bodies, linseed is the most important oil.

I have brought with me a set of samples showing, step by step, the progress of the linseed oil from flaxseed, to finishing varnish. The first sample shows the flaxseed as it reaches the oil crusher—before the mustard and other seeds, the dirt, etc., have been separated by screening, air floating, etc. The second sample shows the raw linseed oil as it reaches the varnish plant—for the manufacture of automobile finishing varnishes of the highest type the varnish manufacturer uses his own refining process. The third sample shows the raw linseed oil after it has been aged in large reservoir tanks until the socalled "foots" or mechanically combined impurities have settled out. The fourth sample shows the oil after it has been put through a chemical refining process, whereby still further impurities are removed. The fifth sample shows the oil after the heat bleaching process—the heating of the oil rapidly to about 600 deg. F.—which removes the sharp yellow color of the raw oil. The next sample shows a still further refining process—that of rapidly chilling the oil to about 20 deg. F.—which chilling removes a small further amount of impurities, and renders the varnishes made from the oil, safer for shipping in cold weather. The seventh sample shows the oil after it has again been heated to about 600 deg. F., and held at that temperature for several hours. This makes the oil much heavier in body, more dense and more tough when dried, and is the last step before combining the oil with the previously melted gum, the driers, and thinners in the manufacture of the varnish itself. The eighth and last sample shows the completed finishing varnish, and on the average at least a year intervenes between the arrival of the raw linseed oil at the plant and the time that the finished product is ready to use.

Each step in this long process is subjected to careful laboratory checking, and the varnish itself, in both its primary and final stages is tested by every possible practical and laboratory method, against standards, to determine its suitability for its intended purpose.

Sealed samples of raw materials, samples of the oils in their various stages and samples of each lot of finished varnish are kept on file under key numbers. Thus there are available at all times not only the written records of the production of a given tank of varnish, but also a complete set of material samples showing the various stages of manufacture from the arrival of the raw materials that went into that particular tank of varnish, up to the final O.K.'d sample of the finished product itself. In addition, each can filled from a given tank of varnish bears the key number of that particular lot of varnish—so that the chain of data is complete—from the producer of the raw materials to the user of the finished product.

With this brief glance at the production of the varnish you use in finishing the bodies you build let us pass on to a consideration of some of the ways—good and bad—in which that varnish is used.

In some automobile plants engineering, unfortunately, stops at the threshold of the painting and finishing department, and from there on materials are used without much understanding of cause and effect as related to the standing up in service of the finish given the car. It is not apparently realized that the proper selection and application of the paint and varnish materials that go to make up the completed finish, is an engineering problem just as is the design and production of the motor or any other important component. A company that turned out a motor with a cast iron crank shaft, copper pistons and a tool-steel radiator would be considered as having engineering talent that was at least open to question. Yet the above extreme illustration is hardly further from sound practice than is one of the automobile painting systems, which I will show you later on and which was in actual use.

Many factors affect adversely the standing up of the motor car finish in actual service and I have brought with me a few panels showing the results of actual exposure tests on automobile painting systems—both good and bad.

Results of Exposure Tests on Automobile Painting Systems

The first pair of panels show two automobile painting systems of similar number of coats and methods of application. In the case of panel A, the system was improperly engineered both as to the distribution of elas-

*By L. Valentine Pulsifer, chief chemist, Valentine & Co. A talk before the Automobile Body Builders Association, Detroit, Mich., June 20, 1922.

tic and inelastic coats and in the selection of the color varnish. The system on panel B was properly engineered, both as to the selection of materials and their proper distribution. Both panels were finished with the same varnishes, at the same time, and were exposed side by side for five months at an angle of 45 deg. from the vertical, facing south. The finish on panel A has deadened to a far greater extent than that on B—it shows an uneven "pebbly" surface and is perished to a greater extent. Now what was wrong with system designated as A?

As you have noticed, about half an inch of each coat that went on the panels was left exposed and a careful check on each material on the panels from the day they were exposed showed that the color varnish of system A was below the normal durability of an automobile color varnish. In addition, it was considerably lower in elasticity than the coats immediately preceding it—a fact that aggravated its own lack of durability. In other words, the proper practice of building down in elasticity from primer to flat color and then up in elasticity from flat color to finish, had not been observed. Thus a condition similar to that shown on the broken elasticity curve of chart 1 was set up. This system (A) not only had a clear sealer coat and a colored sealer coat (elastic ground color), which is bad practice under color varnish, but the color varnish itself was so brittle that it was much nearer to a poor furniture varnish than to a proper type of automobile color varnish. System B, on the other hand, shows a proper selection of materials and their proper arrangement in a balanced system—according to a smooth and unbroken elasticity curve, such as is shown on chart 2.

The materials used on panel A were obtained from several different manufacturers while those used on panel B were all made by one manufacturer.

This second pair of panels, C and D, show in the first place two properly engineered systems—all the materials on panel C being supplied by one manufacturer—while the materials making up the equivalent system on panel D were furnished by five different manufacturers of paint and varnish—but were carefully selected for their ability to "pull together."

These panels, finished with the same varnishes were exposed for six months, side by side, at an angle of 45 deg. from the vertical facing south, and the results on their finished surfaces are identical—showing equivalent results from two systems made up of different makers' materials, but both properly engineered.

As an illustration of the differences of durability obtainable over similar painting systems by the use of finishing varnishes themselves, differing widely in elasticity and durability, these panels form an interesting exhibit. The upper half of each panel (C and D) was finished with a body varnish of the average degree of elasticity used in average body work—namely, a varnish with a 60 point elasticity factor as rated by the kauri reduction test. The lower half of each panel was finished with a body varnish having an elasticity factor under the same test of 160 points—or more than double the elasticity and durability employed in average practice. (Both these varnishes are in use on large production). A glance at the panels show the remarkable difference in service durability obtained by using—to borrow a tire term—an "oversize" varnish. The normal material is badly checked and cracked, while the "oversize" varnish is absolutely intact and would be good for another six months of the same exposure.

In this connection, it may be well to explain that a six months' exposure to the weather at an angle of 45 deg. from the vertical facing south, is equivalent to the amount of weather exposure that the usual automobile body gets in from one to two years. To illustrate to how great a degree the question of angle and direction of exposure enters into the durability of a finishing varnish, suppose we took four panels each, brought up and finished in the same manner and with the same materials. If we exposed one vertically facing north, it would last approximately twice as long as a second panel exposed vertically facing south. The second panel would last approximately twice as long as a third panel exposed at an angle of 45 deg. from the vertical, also facing south—and this 45 deg. panel would last approximately twice as long as the fourth panel exposed horizontally. This great difference in durability, caused by the angle and direction of exposure, is due to the fact that of the three principal factors—changes of temperature, moisture and sunlight—that tend to destroy a varnish exposed to the weather (as an automobile body varnish is exposed to the weather)—the sunlight is by far the most important. The chemical or actinic rays in sunlight break down the vegetable compounds in the varnish and promote the progressive oxidation or "rotting" of the film. All this explains why decks and cowls perish before the body panels and why there is so great a difference in the durability of cars identically painted and finished when used under widely different climatic conditions.

Of course, the durability of the finish on the chassis of an automobile is more affected by its ability to withstand the destructive action of water, mud, alkalis and soaps, than by its ability to resist the actinic rays of sunlight—but on bodies, the chief weather factor is sunlight. Of course, the finish of an automobile has more enemies than the weather—and among these enemies the owner who does not know how to properly care for the finish of his car easily occupies first place. His ignorance presents an important problem, which the automotive industry and the varnish industry should join hands in solving.

I have two more small panels—illustrating how not to paint an automobile. E shows an automobile painting system so hopelessly bad as to equal the before-mentioned motor with the cast iron crank shaft and the copper pistons. It consisted of a perfect hodge podge of elastic and inelastic coats piled on without rhyme or reason—and the results fully measure up to what might have been expected. Panel F shows the strikingly similar result of an exposure test of a very elastic and durable black enamel used over a rubberized cloth of still greater elasticity and flexibility. Both these panels show in a very graphic manner the effect on the finishing coat of upsetting conditions underneath, for they are checked, cracked and "alligatored" from the finishing coat clear down to the original surface.

All the panels I have shown (with the exception of the rubberized fabric), are actual systems either at present in use by some large automobile plants, or systems formerly in use.

Blue and Green Color Varnishes Compared

My final pair of panels show the effect of blue color varnish on the finishing varnish—on panel G, as compared with green color varnish, and on panel H, as counteracted on one-half of the panel by the use of a coat of clear rubbing over the blue color varnish.

Panel C shows the comparative durability of the same

finishing varnish over green and blue color varnish. Both sides of the panel were brought up with exactly the same method and materials—with the exception of the color varnishes—and in making both the blue and green color varnishes, the same rubbing varnish was used. The greater durability of the finishing varnish over the green color varnish is clearly shown.

Panel H, on which the only difference in the two halves is the presence of one-half of a coat of clear rubbing over the blue color varnish, shows in a marked manner how this clear rubbing varnish protects the finishing varnish from the chemically active blue. This chemical activity takes place in the presence of moisture, which in the case of the half coated with the clear rubbing cannot so readily get through to the blue. (Moisture absorption tests have shown that the short oil rubbing varnish is more impervious to moisture than the long oil type of automobile body varnish).

You have probably seen many blue decks and cowls that looked like the badly perished half of this panel—a coat of clear rubbing would have greatly prolonged their life.

There are, of course, many problems and many interesting points in the painting and varnishing of automobiles that lack of time forbids discussing here. I hope the points and problems I have discussed will arouse a greater desire to study this particular field of automotive engineering—both on the part of the automotive industry and on the part of the paint and varnish industry, for in cooperative action lies the path to better results for all our efforts. A scientific study of the problems involved, by as many qualified and interested groups as possible, will yield ample dividends of satisfaction to all concerned.

Gasoline Stocks Decreasing

Gasoline stocks at refineries in the United States July 1 registered a slight decrease from the figures for the previous month, according to statistics compiled by the Bureau of Mines, which show 824,966,456 gallons on hand. This is a decline of approximately 32,000,000 gallons from the figures for June 1, reflecting the normal seasonal drop due to increased use of automobiles in the summer months.

Domestic consumption of gasoline for July was 507,000,000 gallons as compared with 499,000,000 gallons for May and 386,000,000 gallons for April. The May figure represents an increase of 41 percent in consumption as compared with May a year ago, while a similar comparison for June shows a 14 percent increase, a more nearly normal figure. Stocks for June are 10 percent in excess of June a year ago.

Production of gasoline for June amounted to 525,940,600 gallons, an increase of 12,000,000 gallons over May and 51,000,000 gallons over April.

Figures furnished the Bureau of Mines by refiners for the first six months of 1922 show an increase of 9.9 percent in domestic production of gasoline as compared with a similar period in 1921. The increase in domestic consumption is 6.1 percent in excess of this amount or 16 percent.

A daily average of 1,547,000 barrels of oil was run through the stills of the 310 refineries reported as operative during the month of June. These figures show a daily increase of 30,000 barrels in the amount of oils run and a decrease of five in the number of operating plants reporting as compared with the month of May. Plants reported during June were running an average of 88 percent of their daily indicated capacity. In addition to the plants referred to above, it is estimated that there were probably 10 plants of small total aggregate capacity, operating during June from whom no advices of any nature were received by the Bureau of Mines.

Imports of gasoline for June amounted to 3,986,655 gallons; exports were 52,730,889 gallons; and shipments to insular possessions were 1,872,776 gallons.

Production of kerosene for June amounted to 173,649,592 gallons, a daily average increase of 181,000 gallons. Stocks of kerosene on hand July 1 amounted to 317,574,464 gallons, a decrease of 1,300,000 gallons for the month. Exports and shipments of this product were 71,500,000 gallons.

Production of gas and fuel oils in June amounted to 903,056,578 gallons, which is practical maintenance of the May rate of production. Stocks on hand July 1 were 1,326,939,662 gallons which is a slight increase.

The output of lubricating oil for June was 80,138,257 gallons, which indicates a daily average increased production of 95,000 gallons. The seasonal demand for lubricants reduced stocks to a figure of 226,903,812 gallons on hand July 1, a decrease during the month of 39,000,000 gallons.

Only the Rich May Ride in England

"With gasoline selling at 65 cents a gallon and an £18 tax on the cheapest motor car, only the comparatively rich man in England can afford to drive an automobile," stated A. T. Davey, one of the editors of "Engineering Production," a leading English technical journal, during a recent visit to some of the auto plants in Detroit.

Many interesting sidelights on motoring in the British Isles were related by the engineer. He stated that the largest production of any motor car concern in England was made by the Austin car at Birmingham which makes 130 cars a week. This machine sells for about $3,000.

Custom made bodies are almost universally the rule in England, according to Mr. Davey. He explained that all those who could afford a fine motor car preferred to have an individual body, especially after paying the heavy price asked for an imported car.

The employment situation is much better in England at present, he said. During June 70,000 men went back to work. Labor trouble at present is negligible. Salaries, however, are low, even men who head the smaller automobile concerns rarely receiving over $5,000 a year.

Service on automobiles is improving in England but is not quite up to the standard maintained in the United States. The English editor went from Detroit to Chicago, then visited Milwaukee, Dayton and Indianapolis before his return home. He is secretary to the English society which corresponds to the Society of Industrial Engineers in this country.

Ford Making Own Glass

Manufacture of its own plate glass for windshields has been begun by the Ford Motor Co. in a modern plant. Ford production methods have been applied and there is a radical departure from established practice. The Ford continuous conveyor system features the operation so that from the time the glass leaves the furnace until it becomes a polished windshield, it is always in motion.

Fig. 7. Maintenance on this important interstate highway detour would save tourists time, money and temper.

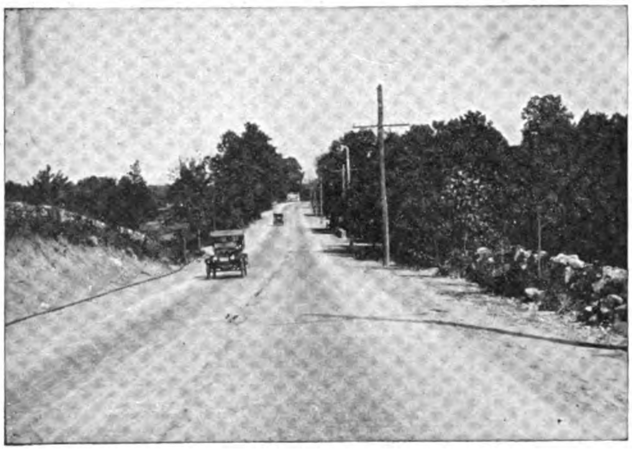


Fig. 8. The temporary inconvenience of a detour is soon past, and if at the end you strike a modern road like this one, isn't it worth while?

Overcoming Drawbacks of the Detour

(Concluded from Page 8)

A charge of $10 is made for this service for the season from June 1 to Sept. 15. This charge barely covres the cost of the blueprinting.

Last season Wisconsin almost doubled the mileage of concrete paving on her trunk highway system, and undertook an unusual amount of grading and temporary surfacing. But in spite of all this construction work, the motorist was not inconvenienced and the well marked highways and detours directed him safely and surely on his tour through the beautiful state of Wisconsin. The "Wisconsin Idea" is to give the traveler service NOW while the roads are being prepared to take care of the traffic of the future. The result is that in spite of the large construction program the many thousands of tourists who visited Wisconsin have traveled over her highways with considerable ease, comfort and satisfaction.

Condition of Auto Industry in Europe

The condition of the automobile industry in Europe presents a striking contrast to the unprecedented prosperity of the industry here, according to D. F. Crawford, president of the Westinghouse Union Battery Co., who has just returned from an extensive European trip made in the interest of the various Westinghouse Air Brake interests.

Germany is making the greatest advances among the states of Central Europe, and the motor car registration in that country equals the previous high water mark of 1914, Mr. Crawford reports.

"The Italian automobile manufacturers are suffering a slow-up in their production," he said. "The war popularized the use of motor trucks; and with an improvement in business conditions there will be a large market in Italy for commercial vehicles.

"In France there has been introduced a measure to repeal the luxury tax on motor vehicles selling for less than 15,000 francs, which if passed will increase the demand for both passenger cars and trucks.

"Great Britain has gone through a lock-out in the engineering trades which ended in June. The industry suffered considerably but is now gradually picking up.

"A high class American automobile laid down in Poland would cost 20,000,000 Polish marks, and there are not many individuals in Poland who are in the market at that price.

"Industries in this country in all lines seem to be more prosperous and on a firmer basis than abroad, although it was my observation that foreign manufacturers are on the road to improvement."

Fig. 9. With at least four markers like this along each mile of well maintained detour in Wisconsin, no hardship is imposed.

The number of automobile tractors and lorries in operation in France increased from 8,000 in 1913 to 93,000 in 1921. The total number of motor vehicles increased from 100,000 to 208,000 in the above period. An increase in the average speed of operation has subjected the highways to an additional strain.

Motor vehicles in Shanghai number 2,500, more than three times the total of horses, according to the Shanghai Sunday Times. Coolie-drawn rikishas, however, are the most popular, numbering 16,000.

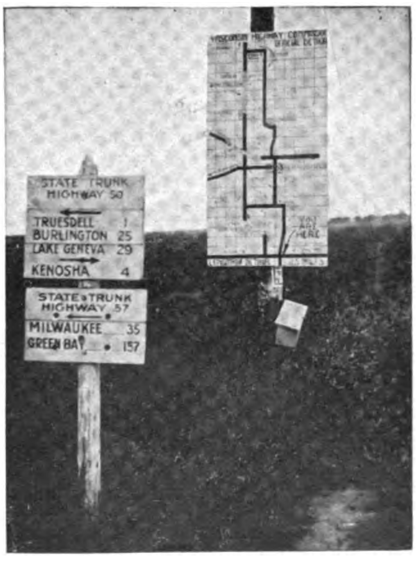


Fig. 10. Signs like this at the beginning and end of a detour tell the length and direction of the route.

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are — What They Are — What They Are Doing

Franklin E. Mills will be made general manager of the Pontiac division of the Fisher Body Corp., which was formerly the O. J. Beaudette Body Co. Mills has been associated with O. J. Beaudette in body manufacture for the Ford Motor Co. for many years. When the sale was made he was secretary-treasurer of the Beaudette company, and was active in the management of the plant.

Col. Lindley D. Hubbell has retired from the post of vice president and general manager of the Hendee Manufacturing Co., and Frank J. Weschler, former treasurer, succeeds to the management and will have complete control of the factory operations. John D. Stephens, who has been assistant to Weschler, is advanced to the office of treasurer.

A. F. Knoblock has resigned as vice president and works manager of the Cleveland Tractor Co., Cleveland, and his brother, H. Knoblock, has resigned as superintendent of that company. They plan to establish plants in Detroit, Cleveland, and other cities for the manufacture of transmission and timing gears for automobiles.

David L. Gallup, for several years consulting and experimental engineer of the Nordyke & Marmon Co., has severed his connection with the company and opened his own office in Indianapolis. He will specialize on investigation advice and reports pertaining to design, material, manufacture, tests and performance.

E. E. Westman has resigned as treasurer of the Kant Kut Tube Products Co., Indianapolis, Ind., to take effect Sept. 1. For several years before assisting in the organization of the above company he was purchasing agent of the Cole and Premier companies. Future plans have not yet been announced.

Wm. H. Lolley, special representative for the Standard Parts Co., sailed for Europe Aug. 1. He will make negotiations with German and French interests for the manufacture and sales promotion of Bock taper roller bearings on the continent, and will visit the British Bock Bearings, Ltd.

Col. E. H. Havens has been made vice president and general manager of the Locomobile Co. of America, Bridgeport, Conn. He was one of the receivers of the old Locomobile company prior to its being acquired by the Durant interests. **D. G. Roos** has been made production manager. Roos was formerly chief engineer.

Robert W. Appleton, production engineer of the Pierce-Arrow Motor Car Co., Buffalo, has been appointed manager of purchases of that company. He will also continue his duties as production engineer. He has been identified with the Pierce-Arrow factory for more than 20 years.

George T. Christopher has been appointed general plant superintendent of the Dayton Engineering Laboratories Co. He was formerly assistant superintendent and production manager. His work with the Delco has been specialization in the manufacturing division.

C. W. Gracey has been appointed manager of the new Minneapolis assembling plant of the Martin-Parry Corp., construction of which is well under way. Gracey has been directing sales at the Detroit assembling plant of the corporation.

F. C. Crawford has been appointed general manager of the Detroit plant of the Steel Products Co., Cleveland. Crawford, formerly sales engineer for all plants, succeeds H. B. Garman, who has become works engineer for all plants.

T. Harris Smith, formerly general manager of the Packard factory branch at Kansas City, Mo., has joined the factory organization of Mitchell Motors Co., Racine, Wis., as manager of advertising and sales promotion.

W. C. Durant has become identified with the Locomobile Co. of America as its active head. A 350 percent advance in the price of Locomobile shares marked the arrival of this announcement on Wall street.

G. A. Ungar, consulting engineer and eastern representative for several automobile parts manufacturers, has been appointed eastern representative for the Liggett Spring & Axle Co., Monongahela, Pa.

George M. Gillette, president of the Minneapolis Steel and Machinery Co., maker of the Twin City Tractor, has resigned, but remains a member of the executive committee and of the directorate.

E. E. Russell, vice president in charge of production of the J. I. Case Threshing Machine Co., has returned from a three months' trip through Europe, where he has been studying conditions.

William A. Schuyler has resigned as president and general manager of the Scintilla Magneto Co., Inc., which is controlled by Brown, Boveri & Co., of Baden, Switzerland.

R. H. Moehn has been promoted to direction of the Buffalo assembling plant of the Martin-Parry Corp. He was formerly connected with the Detroit assembling plant.

Henry Lord, former vice president and treasurer of the Moline Plow Co., has joined the executive personnel of the Velie Motors Corp. and will assume his duties Sept. 1.

Charles Ackerson, formerly manager of the Precision Die Castings Co. plant at Pontiac, is now associated with the sales department of the Saxon company.

George D. Shanahan has been appointed general manager of the Detroit home plant of the J. W. Murray Manufacturing Co.

Chas. F. Remington has been appointed director of advertising and publicity of the Detroit (Mich.) Air Cooled Car Co.

Elwood Haynes and Mrs. Haynes sailed for Europe on Aug. 1 for an extended tour of England and the continent.

Body Builders

Rolls-Royce of America, Inc., Springfield, Mass., is installing machinery in its branch factory for the manufacture of bodies. Owing to the necessity of making the painting and upholstery departments scrupulously clean, new floors and side walls have been built in the workrooms of the six-story section of the Knox Motors building, leased for the purpose. A force of about 100 will soon be at work there under the management of George W. Kerr, superintendent of coach work, with N. H. Manning as assistant manager and purchasing agent, and Jules Olivier, body designer. At the main plant eight chassis a week are meing made, and an increase to 10 a week is contemplated when the coach department gets under way. Orders are now in hand sufficient to keep the factory running on full time through November.

Seaman Body Corp., 1732 Richards street, Milwaukee, manufacturer of passenger car bodies, will let contracts for two factory extensions, one for metal work and the other for wood-working processes. The new building will be ell-shaped, 100 x 423 and 100 x 225 ft., four stories, of

(Continued on Page 32)

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Lafayette Motors Corp., Indianapolis, has completed arrangements to transfer its entire operation, headquarters and general offices to Milwaukee by Nov. 1. Contracts have been awarded for the erection of the first unit of a new LaFayettte passenger car works on Clement, south of Oklahoma avenues, adjoining the four-cylinder car division works of the Nash Motors. The first building will be of brick and steel, 250 x 950 ft., with steel sidewall and monitor sash. The original plant at Indianapolis will be abandoned and placed on the market and the equipment moved to Milwaukee.

Detroit Motors, Inc., care of Backes & Schroth, Broad Street Bank building, Trenton, N. J., representatives, recently organized under Delaware laws to manufacture a six-cylinder automobile, has tentative plans for the erection of a local plant on site being selected. It is also proposed to establish a series of assembling works in a number of leading cities, with local service departments. Offices will be opened at Trenton at once. Milton Wells, formerly connected with Dodge Brothers, Detroit, is engineer and an official of the company.

Durant Motors, Inc., 1819 Broadway, New York, is arranging to transfer different features of production from the Long Island City plant to the new works at Elizabeth, N. J., as soon as the latter plant is ready for service, about the middle of September. The Long Island City works will then be arranged to manufacture a limited number of Flint automobiles for the Flint Motor Co., a recently organized subsidiary. The machinery installation at the new Elizabeth works will require several months for entire completion.

Nash Motors Co., Kenosha, Wis., has let the general contract for a two-story brick and steel addition, 200 x 950 ft., to the four-cylinder car division works in Milwaukee. It will be equipped for general sheet-metal working processes and open body manufacture, including also a new administration building. The project represents an increase of about one-third capacity of the addition originally planned, due to the improved prospects in the passenger car manufacturing industry.

Ford Motor Co. has purchased 60 acres on the Indiana Harbor Canal, East Chicago, Ind., for an assembling plant to cost $10,000,000, according to a report from Gary, Ind. The location of the plant will enable the company at Detroit to ship parts in bulk by water to East Chicago. The tract not only has considerable frontage on the canal, but is also located on the Chicago & Indiana Southern railroad, the Wabash, the Indiana Harbor Belt and the Elgin, Joliet & Eastern.

Ford Motor Co. of Canada will commence building operations on the proposed $6,000,000 plant at Ford, Ont., at once. The first building will be 400 x 1,300 ft., and will be an extension to the present works. It is expected to be completed by January. It has also secured a site on Danforth avenue, just outside the city limits of Toronto, and is preparing to establish a plant to cost about $1,000,000.

Standard Motor Car Co., Pittsburgh, is arranging for the manufacture of a four-cylinder automobile at its recently completed plant at Butler, Pa. It consists of a main assembling works, 200 x 800 ft., with a number of smaller buildings, and will be equipped for an output of about 150 eight and four-cylinder motors per day. The company will remove its headquarters to the Butler plant.

Dayton (O.) Engineering Laboratories Co. will resume the erection of an addition begun in 1920, but abandoned after the foundation was completed. It will be six stories, 190 x 350 ft., with 335,000 sq. ft. of floor space. Products now manufactured by outside firms will be made in the new building, which will also house the service department, now located at Moraine City.

Ford Motor Co. has purchased a site in the Calumet industrial district of Chicago. A tract of 80 acres has been purchased from the Calumet Canal & Dock Co. The property is southeast of the Calumet River and west of Torrence avenue, running south to the South Shore Railroad at about 130th street. An assembling plant will be erected.

Lorraine Motors Co., Beverly, Mich., is perfecting plans for the organization of a new company to take over and operate the plant for the manufacture of automobile parts and equipment. Plans for the manufacture of automobiles have been abandoned. J. L. Dornbos, Grand Haven, Mich., is secretary and treasurer in charge.

Paramount Wheel & Engineering Co. will locate a plant at Hartford City, Ind., for the manufacture of metal automobile wheels. The Chamber of Commerce of that city has purchased a site and will donate it with switching facilities to the company. Work is to be started at once on the factory, which will employ 200.

Ford Motor Co. will take bids this month for its proposed one and two-story plant at Flat Rock, Mich., for the manufacture of plate glass for windshields and other service in connection with its automobile production. The works will cost in excess of $1,000,000 and will include a powerhouse and other buildings.

Durant Motors, Inc., 1819 Broadway, New York, is said to be organizing a new subsidiary, to be known as the Mason Truck Co., for the manufacture of motor trucks. The initial plants will be established at Bridgeport, Conn., and Flint, Mich. It will be operated as an independent unit.

The Columbia Motor Co., 6501 Mack street, Detroit, has leased the plant of the Saxon Motor Co., and will take immediate possession. It will be used for increased production, developing an output of about 200 cars a day, compared with a present production of about 60.

Dearborn (Mich.) Tractor Appliance Co., recently incorporated with a capital of $25,000, will manufacture some of the articles it expects to handle while others will be manufactured under contract. A little later the company may be in the market for equipment.

Brewer Mfg. Co., Inc., 1103 Front avenue, N.W., Grand Rapids, Mich., which has taken over the patent rights owned by Governor Laporte Brewer, Grand Rapids, will erect a plant this year and expects to be able to manufacture the Brewer spark plug by Jan. 1.

Hupp Motor Car Corp., Detroit, has construction under way on two four-story additions, to increase the floor space by about 500,000 sq. ft., making a plant area of over 1,570,000 sq. ft. It is expected to have the structures ready for service by the end of the year.

Ford Motor Co., Highland Park, Mich., has had plans prepared for a new two-story slag-crushing plant at River Rouge, Mich. The machinery will be electrically-operated. Albert Kahn, 1000 Marquette building, Detroit, is architect.

Wills-Sainte Claire Co., Marysville, Mich., manufacturer of automobiles, has preliminary plans under way for the construction of an addition to its local plant, and have established a branch plant at Sarnia, Ont.

Paige-Detroit Motor Car Co., 100 Fort street, West, Detroit, will commence the erection of a new building to

be used as an enameling department and other operating service. William B. Cady is secretary.

Lincoln Motor Co., Warren and Livernois streets, Detroit, operated by the Ford Motor Co., is taking bids for a one-story addition, 250 x 800 ft. Improvements will be made also to present buildings.

Reo Motor Car Co., Lansing, Mich., has leased a small plant opposite the Swedish Crucible Steel Co. plant at Windsor, Ont. The leased plant is to be used by the Reo Motor Car Co. of Canada, Ltd.

Dodge Brothers, Inc., Detroit, has acquired about 7½ acres at Windsor, Ont., for a new branch plant for Canadian business. Plans are under way for construction of the initial buildings.

Stutz Motor Car Co., Indianapolis, has passed to the control of Chas. M. Schwab, of Betlehem Steel. Wm. M. Thompson will continue as president and general manager.

Parker Axles, Inc., 1819 Broadway, New York, manufacturer of automobile axles, with plant at Poughkeepsie, N. Y., has tentative plans for a new factory at York, Pa.

Spicer Mfg. Co., South Plainfield, N. J., manufacturer of universal joints and other automotive products, will build a one-story addition to cost about $26,000.

Lincoln Motor Co., Detroit, has revised plans in preparation for an addition, one-story, 250 x 880 ft. Albert Kahn, 1000 Marquette building, is architect.

Par-Kar Coach Co., Detroit, manufacturer of automobiles, has acquired the plant of the Bollstrum Truck Co., St Louis, Mich., for new works.

Packard Motor Car Co., Detroit, is having plans prepared for a one-story building, estimated to cost about $40,000.

Daniels Motor Car Co., Reading, Pa., is arranging to double the present plant capacity.

Body Builders

(Continued from Page 30)

brick and mill construction. The present factory was erected two years ago. The Nash Motors Co., Kenosha and Milwaukee, is one of the principal owners of the Seaman company. Harold S. Seaman is secretary.

Haynes-Ionia Co.'s new finishing plant containing 70,000 sq. ft. of floor space is completed. This means the employment of from 400 to 500 additional men, and increasing of production 33⅓ percent. The new building is of hollow tile construction two stories high and situated immediately south of the plant proper at 7th street and Muskegon avenue. It will be devoted to trimming and final assembly and besides relieving present congestion will allow for expansion.

Coupe DeLuxe Body Co., St. Louis, Mo., closed a long term lease on the two-story building at the southeast corner of 13th street and Morrison avenue, containing 38,000 sq. ft. This is the third factory building leased by this company to manufacture auto bodies. Their main office and showroom is located at the southwest corner of 19th and Locust streets. In addition to this they have a large factory at 1125 North Broadway.

American Motor Body Co., Philadelphia, successor to the Hale & Kilburn Co., is now operating at 50 percent of capacity, with the schedule to be gradually advanced until November, when it will be at 100 percent. Night work is necessary at present in some departments. The company recently closed a contract with Durant Motors, Inc., for the manufacture of 50,000 car bodies.

Martin-Parry Corp., York, Pa., manufacturer of automobile bodies, has leased a portion of building No. 18 at the plant of the Dort Motor Car Co., Flint, Mich., totaling about 15,000 sq. ft., for the establishment of a local plant. Initial operations will be devoted to assembling work. It is said that additional units will be established in the near future.

Biggam Trailer Co., formerly located in the First Wisconsin National Bank building, Milwaukee, has completed the equipment of its permanent plant at Racine, Wis., where it occupies 18,000 sq. ft. in the Racine Industrial Community building, Racine Junction. It is now manufacturing a line of trailers ranging in capacity from 800 lb to 5 tons.

C. R. Wilson Body Co., Detroit, will complete by Sept. 1 a six-story addition to its present plants which will give it about 300,000 more feet of manufacturing space. The building will be a complete unit in itself, the three lower floors being devoted to body building and the three upper floors to the painting, upholstery and finishing departments.

Inland Body Co., Indianapolis, manufacturer of automobile bodies, is planning the erection of new works at Columbus, Ind. The present business will be removed to the new location and additional equipment installed. The Columbus Chamber of Commerce is interested in the project.

Lebarron Carrossiers, Inc., New York, will manufacture automobile parts, motors and particularly bodies. Its capitalization is $10,000. Incorporators: R. S. Roberts, T. L. Hibbard and R. H. Dietrich. The company is already manufacturing. Address W. H. Ives, 38 Park Row, New York.

Tourist Camp Body Co., Chicago, Ill., has been organized to manufacture and deal in automobile and other vehicle bodies and accessories. Capital $10,000. Incorporators: Hans Jochims, George S. Haskell, C. Oscar Carlson.

Wisconsin Auto Top Mfg. Co., Racine, which is enlarging its works, has increased its capital stock from $300,000 to $600,000, consisting of 5,000 shares of common and 1,000 shares of preferred stock.

Chevrolet Motor Co., of California, 69th avenue and Foothill blvd., Oakland, has had plans prepared for an addition to manufacture automobile bodies. W. C. Williams is manager.

McKays Carriage Works, Erie street, Grove City, Pa., manufacturer of automobile bodies, will build a one-story addition, to cost about $16,000. A list of equipment is being arranged.

Forsechler Wagon Mfg. Co., New Orleans, has plans under way for a new two-story factory, 60 x 150 ft., estimated to cost $25,000, including equipment.

Arrow Body and Wagon Works, Manhattan, N. Y., capital $15,000, has been incorporated by H. Melnic, L. Rubin, H. Brown.

Hupmobile Motorcar Co. has purchased the interests of the Mitchell Motor Co. in the H. & M. Body Corporation at Racine, Wis.

Hastings Body Co., Wilmington, Del., has been organized to manufacture automobile bodies, etc. Capital $100,000.

Fisher Body St. Louis Co. has been organized under the laws of Delaware. Capital $1,000,000.

Van H. Cartmell

Van H. Cartmell, for many years president of the Kelly Springfield Tire Co., died at his home in Springfield, O., early Wednesday morning, Aug. 23.

Mr. Cartmell was for many years vice president of the Rubber Association of America. Two years ago ill health made it necessary for him to retire from active business.

Maryland Objects to Green Visors

Automobile Commissioner E. Austin Baughman of Baltimore, Md., is framing an action to prohibit use of green opaque visors on headlights. He maintains they throw a glaring light on the road surface, the reflection of which tends to blind the oncoming driver.

The oil resources of the world are estimated by the U. S. Geological Survey at 63,000,000,000 barrels.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

2461—A city in Mexico is in the market for one or more street sprinklers suitable for using salt water, and to be mounted on automobile chassis or trucks. Quotations desired f. o. b. factory. Payment: Cash with order. Correspondence should be in Spanish.

2543—The purchase of supplies of all kinds connected with the automobile trade is desired by a firm in Sweden. Quotations should be given f. o. b. New York. Reference.

2548—A company in South Africa desires to purchase and act as agents for the sale of motor accessories, tires, and mechanical rubber goods. Quotations should be given c. i. f. Durban or f. o. b. vessel in New York. Payment to be made against documents. Reference.

2549—A mercantile firm in Canada desires to purchase automobile accessories. Quotations should be given f. o. b. factory. Cash to be paid. Reference.

2550—A merchant in Italy wishes to secure an agency and purchase typewriters, motor cars, bicycles, and motor cycles. Quotations are desired c. i. f. Italian port. Correspondence should be in Italian or French. Reference.

2722—A mercantile firm in Australia desires to secure agencies for the sale of all kinds of automobile accessories. Quotations f. o. b. New York. Cash to be paid in New York. References.

2756—A dealer in automobiles, trucks, motor cycles, tires, tubes, and other automotive accessories, in Siberia desires to secure the representation of manufacturers of all kinds of makes of these products. References.

2766—A wholesale merchant in Italy desires to purchase and secure an agency for figured and plain oilcloth in 12-yard pieces, and cork linoleum. Quotations c. i. f. Italian port. Terms, payment against documents in Italian bank. Correspondence, Italian or French. Reference.

2781—A mercantile firm in Sweden wishes to purchase bicycle and motorcycle chains, parts for motorcycles, motors, and other parts in the automobile and motor trade; and also secure an agency for the sale of a good automobile to cost about 4,000 crowns in Sweden. Quotations, c. i. f. Swedish port. Reference.

2784—A merchant in Italy desires to secure an agency from manufacturers for the sale of hardware and tools, and automobile accessories. Quotations, c. i. f. Genoa. Reference.

2837—A mercantile company in Syria desires to purchase sporting goods, bicycles and motor cycles. Quotations, c. i. f. Beirut. Terms: 25 percent with order and balance against documents. Correspondence, French. Reference.

2840—An industrial firm in South Africa desires to purchase stoves for baking enamel on automobile bodies. Reference.

2903—A mercantile firm in Spain wishes to purchase or secure an agency for automobiles and accessories. Quotations, c. i. f. Spanish port. Correspondence, Spanish or French. Catalogs and price lists are requested. References.

2971—A merchant in Italy desires to secure an agency for the sale of imitation leather for the furniture and automobile industries. Reference.

3056—A business man from London, England, is in the United States and desires to be placed in touch with manufacturers of automobile accessories, oil-handling equipment, advertising novelties and signs, and other special manufacturers' lines that might find a market in England. References.

3092—A commercial agent in Spain desires to purchase and secure an agency for automobiles, tractors, trucks, and automobile accessories. Correspondence, Spanish. References.

3098—A mercantile firm in Czechoslovakia desires to purchase tires, solid tires, automobiles, and motor cycles, and spare parts for same. Quotations, c. i. f. German, French, or Holland parts. Reference.

3138—A commercial agency firm in England desires to secure the representation of dealers in hardware, provisions, motor and cycle accessories, and fancy goods. Payment to be made through bank in London. References.

3140—A mercantile firm in Germany desires to purchase and secure the representation of exporters for the sale of gasoline, gas, oil, and fuel oil, of first qualities. Quotations, c. i. f. Hamburg. References.

3141—The representative of a firm in South Africa is in the United States and desires to secure an agency for the sale of hardware, electrical supplies and equipment, and automobile accessories. Reference.

3145—An agency is desired by a business man in the Canary Islands for the sale of automobiles and accessories. Reference.

3156—An industrial firm in Mexico desires to purchase six 8-wheel log wagons for transporting timbers from forests. Quotations, f. o. b. factory, or c. i. f. El Paso, Tex. Payment, cash. References.

3158—A firm in South Africa wishes to purchase a cold tire setter to shrink any size up to 1 in. by 4 in., side grip, heavy side-grip pattern. Reference.

3197—Commercial agent in Sweden desires to secure the exclusive representation of firms for the sale of motors, automobiles, flying motors, tractors, woodworking machinery, etc. References.

3223—A commercial agent in Italy wishes to secure the representation of firms for the sale of American clincher automobile tires. Quotations. c. i. f. Genoa. References.

3227—Firm in eastern Sweden desires to secure an agency for the sale of lubricating oils in large quantities. Quotations c. i. f. Stockholm. Terms, cash against documents. Reference.

3246—An inquiry has been received from a firm in Sweden for an agency of automobiles, both trucks and passenger cars. A moderately priced car not already on the Swedish market is desired. Quotations, c. i. f. Stockholm. Terms, cash against documents. References.

3253—Commission agents in Spain wish to secure an agency for the sale of automobiles and mineral oils. Quotations, c. i. f. Gijon, Santander, or Bilbao. Correspondence, Spanish. References.

The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1, Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3, Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

MADE TO ORDER

and Delivered on Time

RIVETS Made to order only. .035 to .375 diameter
ESCUTCHEON PINS Carried in stock in Brass and Iron
Made to order in other metals

Send sample or rough sketch for estimate and state quantity wanted. Quantity makes the price

JOHN HASSALL, Inc. Clay and Oakland Sts., Brooklyn New York Established 1850

The Best Bearing Metal on the Market

FAHRIG ANTI FRICTION METAL

A Clean, Homogeneous Tin-Copper Alloy Made by Our Special Formula From New Raw Material for Use as a Babbitt

FAHRIG METAL CO., New York

WILCOX

FINE FINISHED FORGED

CARRIAGE HARDWARE AND GEAR IRONS

Write for Prices and Catalog

The D. Wilcox Mfg. Co.
MECHANICSBURG, PA.

ECONOMIST-ENGINEER
Constructive Policies—Ways and Means—Diagnosis
Production—Managements—Sales—Exports

W. J. SPENCER M. E., E. E., L. L. D.

Manufacturer & Builders' Exchange
410-416 Bond Building WASHINGTON, D. C.
Pittsburgh — Cleveland — Chicago — Dallas

Tycos temperature instruments

Assure maximum quality by minimizing mistakes where temperature is a factoı in your industry. Proved by results where *Tycos* instruments are installed.

Taylor Instrument Companies
Rochester, N.Y. U.S.A.
There's a *Tycos* and *Taylor* temperature instrument for every purpose

SUBSCRIBE TO
The AUTOMOTIVE MANUFACTURER
the Best, and at the same time, the Cheapest Journal covering the Automotive Field
Only $2.00 a Year **Subscribe Today**

Electrical Testing Laboratories

80TH ST. AND EAST END AVE., NEW YORK

Electrical Photometrical and Physical Test
TESTS OF
Head Lamps, Chemical and Metallographic Examinations of Steel and Iron, Lubricating Oils, Gasoline, etc.

PORTER'S BOLT CLIPPERS

"Easy" "New Easy" Allen-Randall

To Cut 5-16, 3-8, 1-2, 5-8, 3-4 Inch.
H. K. PORTER, EVERETT, MASS.

KRAKNO

Is the greatest filler or surfacer known to the Auto Painter. You can't afford to operate your Paint shop without it. Price $3.50 per gal. Send for descriptive circular.

The R. F. Johnston Paint Co.
Cincinnati, Ohio

Why Not Have the Best?

One of a Large Variety
C. Cowles & Co.
NEW HAVEN, CONN.

THE CHARLES WING CO.
Established 1848
Manufacturers and Wholesale Dealers in
AUTOMOBILE AND CARRIAGE HARDWARE AND TRIMMINGS
AMESBURY, MASS., U. S. A.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. LXIV. No. 6 SEPTEMBER, 1922 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3.

The Automotive Manufacturer

A Consolidation of The Hub and Automotive Engineering

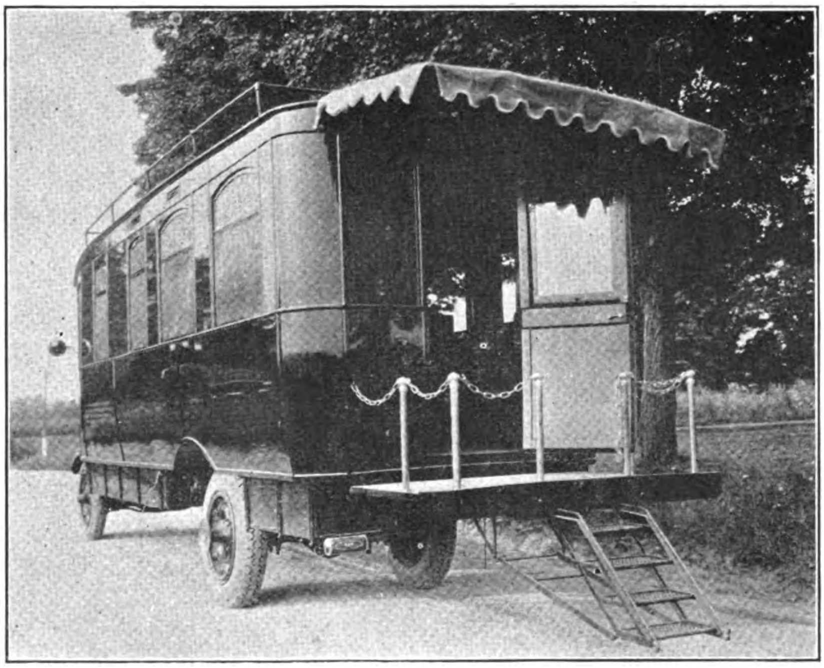
Vol. LXIV. NEW YORK, SEPTEMBER, 1922 No. 6

Palatial Touring Body on Truck Chassis

Practically All Known Comforts and Conveniences Combined in Special Body Built on Truck Chassis—Intended for Circling the World.

IT WOULD seem that the combination of space, comfort and convenience in touring car can go no farther than the vehicle recently completed by a middle-western firm of body builders and shown in the accompanying illustrations. As it happens the story of this vehicle hides within it an element of the daring explorer which is perhaps latent in all of us, as well as a touch of the pathetic in that the man who conceived, designed and had the body built was injured getting out of it shortly after he had received it and before he put it into actual use, and died as a result of these injuries.

As the first illustration shows it is on the nature of a palace car on pneumatic tires. Within this large and commodious body are to be found, besides the driver's compartment which can be shut off from the other parts of the body, a bathroom, a kitchen, a hallway between these, a drawing room which is really a combination of living room and bedroom, and at the rear end, outside of the body proper, an observation space or platform.

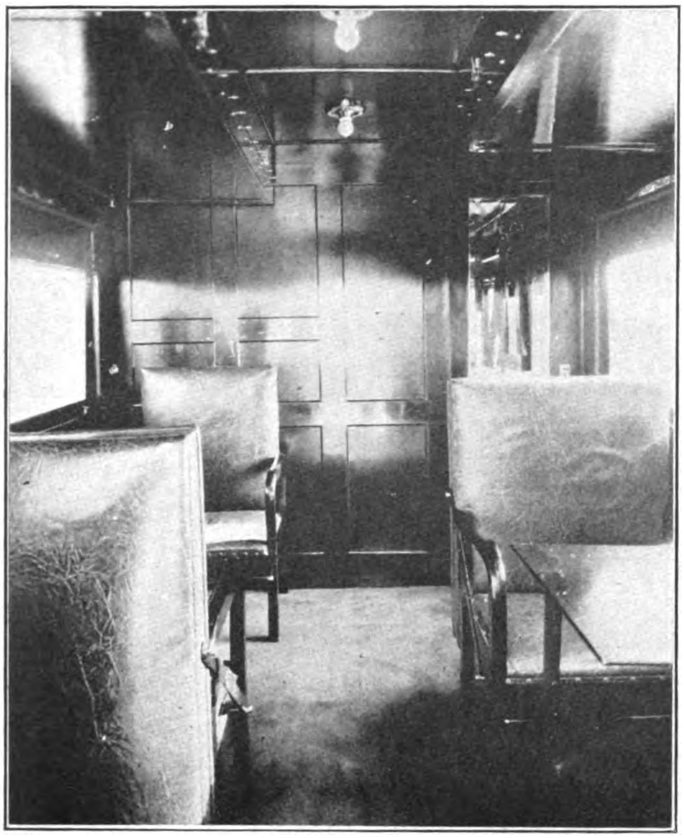


Palatial touring body mounted on truck chassis.

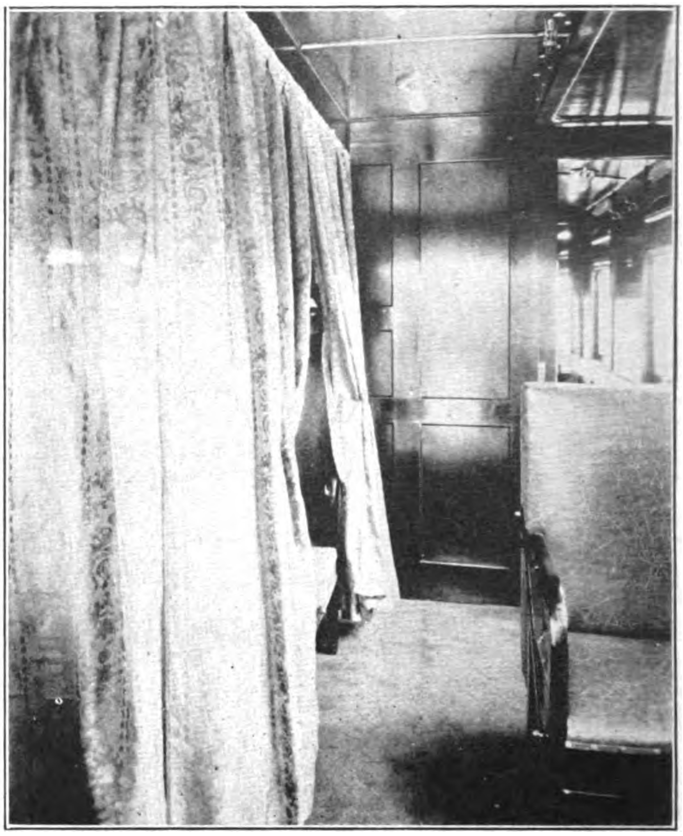
This body was built by the United Automotive Body Co., Springboro Division, Springboro, Pa. It was built for Andre Boutin of Syracuse, N. Y., who conceived the idea and planned it out. Mr. Boutin, who was 77 years old, was an advocate of universal peace, and he had planned to use the car for a tour of the world on which he intended to spread his doctrines of peace. He had planned to tour the United States first, starting from Syracuse in September, 1921, and later touring the other countries of Europe in 1922, and China and the Far East in 1923.

The car was delivered in August, 1921, and just a few days before he had planned to start, before he had actually used the car, he stepped out of the front door without throwing the disappearing steps out, with the result that he fell to the ground, and received internal injuries from which he died 48 hours later.

In general the body layout is as follows: the front end of driver's compartment is of full width and equipped with doors into the body, which may be closed at will. Back of this is the bathroom and kitchen on either side of a short central hall, leading back to the drawing room. The latter fills the whole rear end of the body, and at the rear is equipped with double doors which may be opened to lead out onto a large observation platform, which may be drawn out from under the body. A canopy top may be drawn out also, and when it is desired to stay in one place for a considerable time or use the observation platform for a long time, supports may be placed under it.



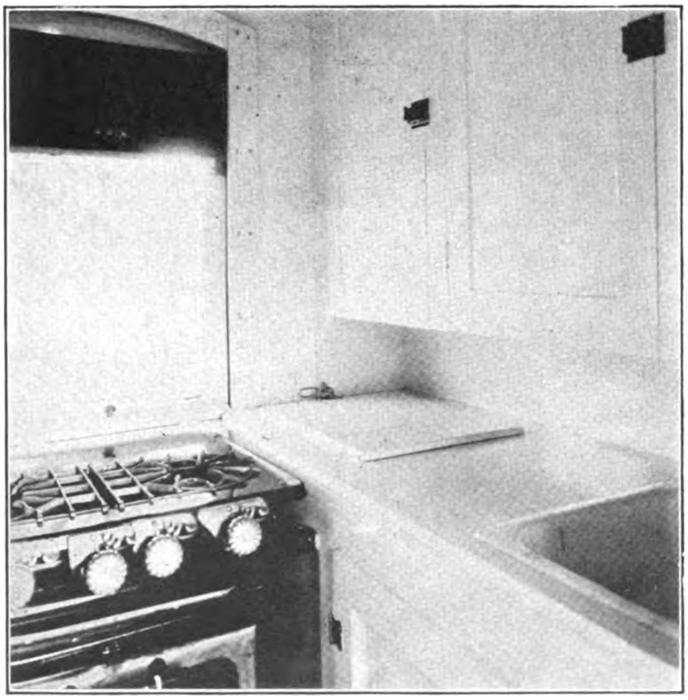
Drawing room showing bed made up and enclosed by curtains.



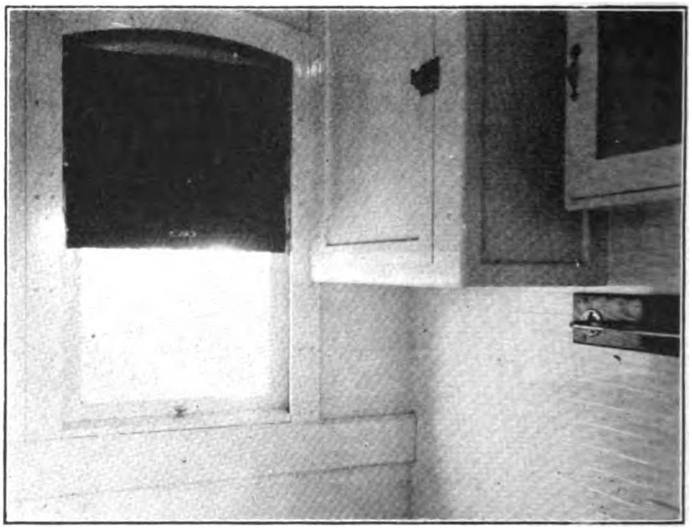
Drawing room, a combination of living room and bedroom.

Around the sides of the chassis, beneath the overhang which is considerable, as will be noted by consulting the dimensions given elsewhere, are a series of compartments for luggage, tanks for gasoline or other fuel, oil, water, other necessities or equipment. This arrangement with this large size of body gives a very large amount of space, and with the similar interior space arrangements of driver's compartment, kitchen pantry and bathroom, permits of carrying everything needed by the occupants for considerable periods.

All of this was very well thought out for there are many places in the world, not to overlook some parts of our own west and southwest, where such provisions are imperative. Thus, the fuel carrying capacity was 100 gallons. The vehicle is said to do 10 miles per gallon of fuel (which sounds extremely high, considering its total weight of more than 18,000 lbs.), so that the vehicle could carry



Kitchen



Bathroom. The tub and washbasin stand under the window and are not shown.

its own fuel for a distance of 1,000 miles. Again, the water carrying capacity of the vehicle's tanks is 120 gallons. Considering the engine should not need to exceed 2 or 3 a day on the average, even in hard rough going,

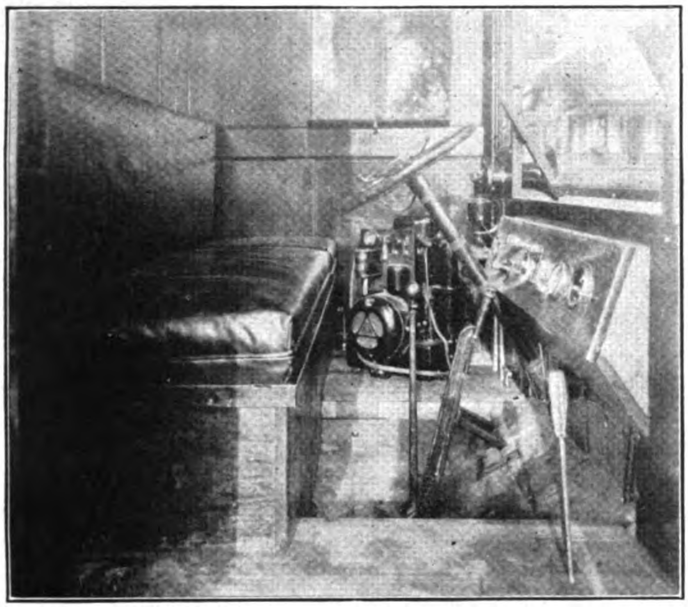
this would give a reserve water supply of 60 gallons for the users of the car, over and above an ample three weeks' reserve for the engine.

The body as illustrated in the accompanying illustration is 23 ft. long, 84 in. wide and 8 ft. high from the floor to top of rail. It is covered on the outside with ½ in. haskelite and finished in a rich cherry, trimmed with jet black. The interior of the driver's compartment, hallway and drawing room is paneled in ⅜ in. haskelite, finished in American walnut in the driver's compartment, and mahogany in the hallway and drawing room.

The bathroom and kitchen are paneled in vehisote and grooved to imitate tile, finished in white enamel.

The body is fitted with pullman style upper and lower berths, copper screens, plate glass windows throughout, drop sash, pullman shades; kitchen complete with cooking and baking stove, 150 lb. ice refrigerator, china closets, sink, running water, ice water fountain, drain, etc. Bathroom is complete with bath tub, lavatory, toilet, medicine cabinet, linen cabinet, towel racks, etc.

Driver's compartment has an extension on an unusually wide seat, making a full length berth at night. This is made very private by heavy roll-up shades at all windows and windshield. There are also provisions made for his luggage in large lockers over his seat.



Driver's compartment

Berths are fitted with blue rajah silk draperies, which harmonize with the blue wilton rugs, which cover the floor of the hallway and drawing room. Inlaid linoleum is used in the kitchen and bath.

Every convenience is found in this body that you would find in the modern city home. Plenty of lights are furnished by a 32-volt Delco with four large storage batteries under the seat. A water pressure of 40 pounds is maintained while running from the two-cylinder Kellogg power pump with a pressure gauge on the driver's instrument board. This can be operated while in motion and a constant pressure maintained. Each room has and at each end of the hall or passage-way are concealed sliding doors, finished to match the woodwork.

On the rear of the car there is a 6 ft. by 7 ft. observation platform that folds over and slides back under the body between the lockers and sills. This platform is equipped with heavy brass posts and chains, folding iron steps and a disappearing awning that can be drawn out from the top of the body. Spacious lockers are provided the full length of both sides of the car, which gives ample room for water, gasoline and oil tanks, also for tools, dunnage and luggage of all description. The chassis is equipped with hub winches on the rear wheels, towing hooks in front and a four-speed ahead and one reverse speed transmission.

The car has a wheelbase of 200 inches.

Chassis, body and equipment with tanks filled, weigh approximately 18,000 pounds. It carries 120 gallons of water, 100 gallons of gasoline, 20 gallons of oil. All of this weight is carried in lockers and hung below the chassis frame, which overcomes any tendency of topheaviness. It has a speed up to 30 miles an hour and a fuel capacity of 1,000 miles.

Tariff Bill Will Stimulate U. S. Trade Abroad

"The newly agreed upon export features of the U. S. tariff, assuring equality of treatment in nonmanufacturing as well as industrial countries, will stimulate American automotive trade abroad," according to J. Walter Drake, chairman of foreign trade committee of the National Automobile Chamber of Commerce.

"Under the general export feature the newly lowered automobile rate of 25 percent, if conditions warranted, could be increased by one-half, bringing it up to a maximum of 37½ percent. If some manufacturing country were unwilling to allow a duty as low as 25 percent on American vehicles in return for an equally low rate on its automobiles brought into the United States, steps could be taken to have a higher rate up to 37½ percent apply.

"In the extension of our trade with non-industrial countries, the general export feature of the tariff will also prove helpful. Finland is one of these countries. At the present time American manufacturers are at a handicap there, because French exporters pay a duty of 10 percent compared with 40 percent assessed on U. S. automobiles. With means now being provided, such a discrimination would be discouraged either by concessionary or higher duties on paper and other products imported into the United States from Finland."

Packard Foregoes Vacation Period

The annual two weeks' shutdown was eliminated by the Packard Motor Car Co. this year through the willingness of the factory employes to stick on the job and push cars through. It has been customary for those employed by the company ten years to receive two weeks' vacation with pay and for men employed five years to receive full pay for one week. As a result of volunteering to forego this leave absence, employes will receive two and one weeks' full pay, respectively, as a bonus in addition to their regular pay.

Every possible effort is being made by the organization to meet the demand for cars from dealers. Although production has been increased as rapidly as possible a shutdown of two weeks would have resulted in a further increase in unfilled orders. At present approximately 8,000 men are employed.

Post-War German Car Shows Many Unusual New Features

Liberal Use of Light-Weight Metals Produces Light-Car Weight in Big Machine of 137-Inch Wheelbase—Extremely Long Stroke—Automatic Gear Shift.

BEFORE the war, the Germans were large exporters of motor cars and trucks, and a determined bid for much of this former business is now being made. This is not being done, however, with any old or out of date designs, but rather with ultra-modern designs in some parts of which the car and airplane experience of the war may be detected. Among those German cars which show remarkable new ideas in motor car construction none is more remarkable than the Szawe, illustrated herewith.

This machine is manufactured by Szabo and Wechselmann of Berlin, and takes its name from the first three letters of one name and the first two of the other, joined together. The car is a high-powered quality product intended primarily for the export trade. It was designed by Dr. Bergmann, consulting engineer, formerly chief designer of the Bayerische Motoren-Werke, and the N. A. G. In this new model, the war-born capacity of Germany for producing aluminum and aluminum alloys in large quantities, and consequently, very cheaply is taken full advantage of. It is said to be the first German car into which light alloys enter to a large extent. As will be noted later, by this reference is had not to a few parts but to cylinder block, crankcase, pistons, rear axle housing, and others.

The chassis is laid out to meet fully the requirements of body builders. As will be seen from the views of the chassis in Figs. 1 to 3, the side members of the frame are straight from end to end, there being no insweep at the front. All of the mechanical parts behind the dash lie beneath the top plane of the frame, so that there is a plane surface, bounded by straight lines, for the body builder to work on. The front springs are semi-elliptic, while the rear springs are of the cantilever type and of great length, which results in an unusual length of frame (110 in.) back of the dash.

Extensive Use of Aluminum Alloy

The cylinders and top part of the crankcase are cast as a unit in a block of silumin, an alloy of silicon and aluminum, with thin steel liners cast in the block (see Fig. 4). The bore is 62 mm. and the stroke 140 mm. (2.44 by 5.51 in.), the length of stroke thus being greater than twice the bore. It is claimed that at 2,400 r.p.m. the engine develops 50 h.p.

An interesting feature of the engine is the patented piston, which is also of silumin. As may be seen from the sectional view of the engine, the combustion space is not surrounded by water-cooled walls, but is mainly in the hemispherical cavity of the piston head. At the moment of highest temperature, and therefore of maximum heat loss, the combustible gases are not in direct contact with water-cooled walls, and it is claimed that this results in a material increase in fuel economy. Overheating is prevented by the high heat conductivity of the silumin, the heat absorbed by the piston being conducted to the lower, cool part of the cylinder walls.

The upper end of the connecting rod is secured to the hollow piston pin, which has bronze bearings in the piston bosses. Lubrication of these bearings is effected through inclined holes from an oil groove on the piston immediately below the lowest piston ring groove. The crankshaft is supported in four babbit bearings.

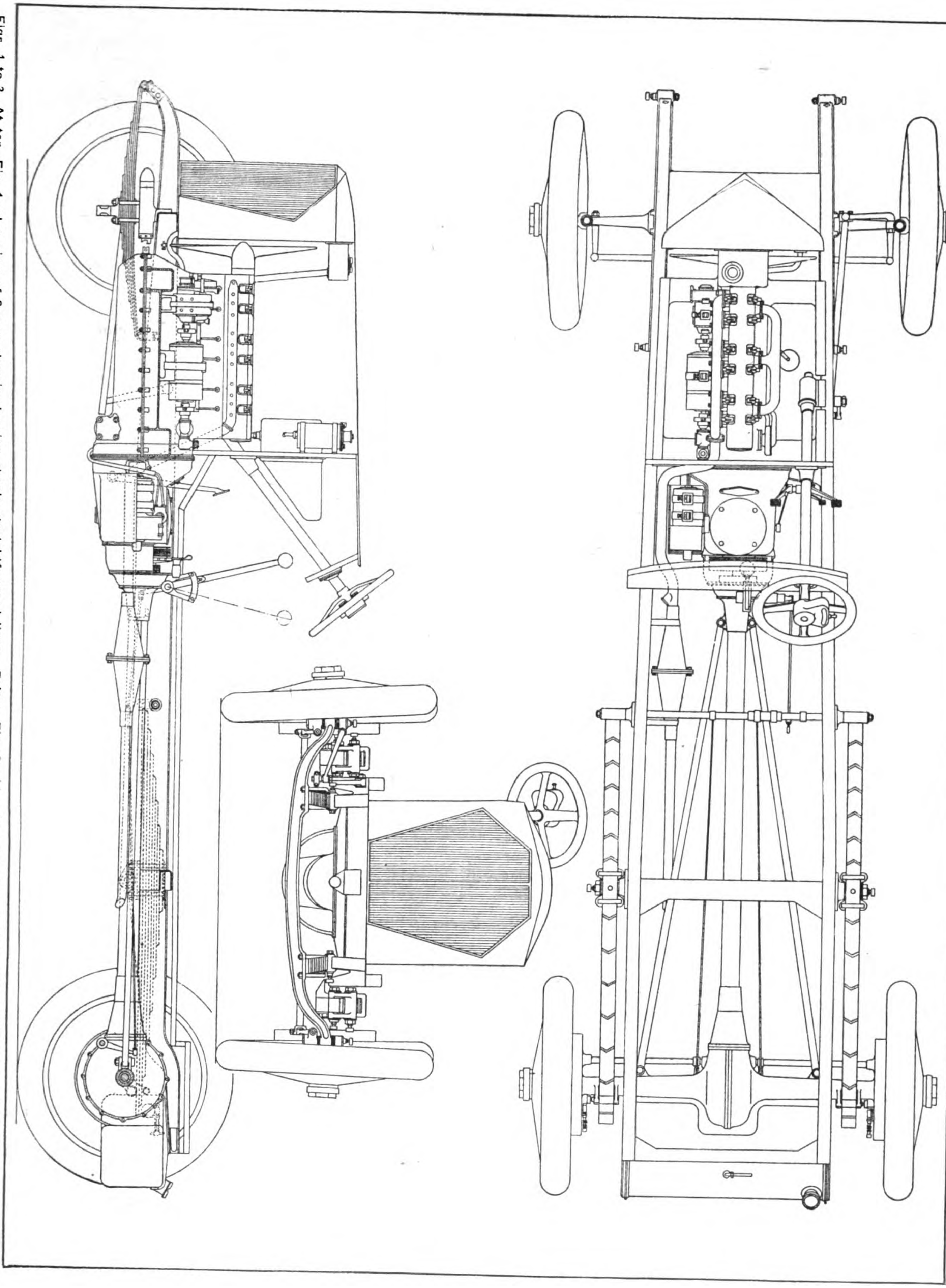
The valves are inclined toward each other at an angle of 60 deg. in the detachable cylinder head, and are operated by means of rocker levers from a common camshaft, which is driven from the crankshaft through a vertical shaft and bevel gears at the rear end of the engine. The camshaft drive is completely enclosed and arranged in such a manner that the timing is not disturbed when the cylinder head is taken off. The inclined position of the valves, together with the concave piston head, results in a substantially spherical combustion space, which makes for high thermal efficiency. The relatively long piston stroke tends further to cut down the area of wall surface to which the hot gases are exposed during the early part of the power stroke, and thus to increase the thermal efficiency. Notwithstanding the long stroke, the engine is comparatively low, and no annoying vibration is experienced.

Airplane Type of Lubrication System

All parts of the lubricating system, including the piping, are arranged in the lower part of the crankcase. Lubrication is by what is known as the dry crankcase system, that is, there is no supply of oil in the crankcase. Similar systems are used on some aircraft engines. A four-part oil pump is fitted, to insure uniform supply of oil to all wearing parts without over lubrication of any one part (see Fig. 7). The oil pump is located in a depression in the bottom half of the crankcase and is driven through a worm gear. On the pump shaft there are three eccentrics, two of which operate a differential or stepped pistons, while the middle eccentric operates the piston valve for the pump. The main pump piston delivers oil under high pressure to all of the main bearings of the crankshaft. From the rear bearing the oil ascends through a cast-in copper tube to the cylinder head, flows through the hollow camshaft to the camshaft bearings and cams, and on its return to the oil pump inlet passes through the bearings of the vertical driving shaft. The crankpin bearings are lubricated through the hollow crankshaft.

If, while driving downhill for extended periods, a considerable amount of oil collects in the forward part of the crankcase, a second pump piston draws this oil back to the oil well in which the pump is located. A third, smaller pump piston draws oil from an oil tank located above the oil pump and delivers it to the engine system to make up for oil consumed. The fourth piston serves to maintain th e level in the oil sump where the pump is located, pumping all excess back to the oil tanks. By this ingenious arrangement the engine gets only as much oil as is necessary for good service and over-oiling is prevented.

Continuous webs are formed between the crankcase arms, extending from the crankcase to the frame, side members, thus rendering a sheet metal underpan unnecessary. The generator and magneto are located on the left side of the engine. These are driven by bevel gears from



Figs. 1 to 3 At top, Fig. 1, plan view of Szawe chassis showing simple straightforward lines. Below, Fig. 2, side view showing straight side members for body-builders' convenience. Center, Fig. 3, front view indicating pointed radiator.

the vertical shaft. The water pump is located on the right side of the engine and is also driven by bevel gears from the vertical shaft. The fan is driven at twice crankshaft speed from the front end of the camshaft by an enclosed planetary drive. The rotary speed (4,800 r.p.m.) and a large fan diameter called for a special design. A two-bladed wood propeller of the same shape as an airplane propeller, with a paroboloidal hub to prevent air eddies, is used. The high position of the propeller results in a better utilization of the free space above the engine. In consequence of the good fan efficiency the high pressure centrifugal pump, and the good heat conductivity of the cylinder and piston material, the compression ratio of the engine could be made unusually high.

The carbureter is a vertical type Zenith. Air flows through the crankcase bearing walls around all bearings, and through cast passages to the carbureter. In abstracting heat from the bearings the air is slightly preheated, while at the same time the bearings are cooled.

The dry plate clutch has a driven plate of thin steel sheet of such a small mass that a clutch brake is not necessary Six small springs produce the necessary pressure. The plates are lined with Ferodo-asbestos, interlaced with copper wire. No clutch release levers are used, their place being taken by a large screw, by which means back lash is avoided and smooth starting insured.

Automatic Gear Shifting

The gearset has four speeds and reverse, and is of entirely new design, the gears being shifted automatically and the gear lever dispensed with. The design is by Count Soden and the gearset is built by the Zahnradfabrik Friedrichshafen. A diagrammatic sketch of this interesting transmission is shown in Fig. 5. It has three shafts (main shaft above) and all gears are continually in mesh, change of gear being effected by means of dog clutches. Gears 1, 2, 3 and 4 are loose on their shafts but can be connected with them by dog clutches. All other gears are firmly secured to their shafts. The first speed is obtained through gears 5, 1, 9, 8 by engaging gear 1 with the corresponding dog clutch. In the same manner, the second speed is obtained through gears 6, 3, 9, 8 and the third gear through gears 7, 4, 10, 8. The fourth speed or direct drive is obtained by engaging pins 11 with holes 12. The reverse is through gears 5, 1, 2, 10, 8 and is obtained by an axial movement of gear 2 with the corresponding dog clutch. Gears 1 and 2 of the two secondary shafts mesh with each other, but gear 5 of the main shaft meshes only with gear 1. The number of gears is 10, the same as in the usual 4-speed gearset, but the secondary gears are distributed between two shafts and the transmission therefore is very short.

Every sliding gear can be shifted individually and is connected by a shifter fork with a shifter bar. The shifter bars are pressed by springs in the direction of engagement, but are ordinarily prevented from moving in that direction by a rotatable shifter cylinder resting against pins of the shifter bar. The cylinder has on its circumference axially offset holes into which only one shifter bar pin can enter at one time, according to the position of the cylinder. When the bar is in position the gear belonging to it is locked.

The shifter cylinder has on one end two projecting pins which are connected through a small worm and bevel gear mechanism and Bowden wires to the pointer and level of the gear selector on the steering wheel, so that if the selector lever is turned, the shifter cylinder is turned also (see Fig. 9). The shifter cylinder can be turned only when none of the shifter bar pins are in the locking hole and when it is freed from the spring pressure, resting on the shifter bars. This is effected by connecting the clutch pedal with the camshaft C so that by pressing down on the clutch pedal this camshaft is rotated and all shifter bars are withdrawn at once. The rotation of camshaft C begins only when the clutch pedal is completely depressed.

The lever of the gear selector is not rigidly connected with the shifter cylinder, but first operates a spring device, which in turn rotates the shifter cylinder if it is free. Therefore, the effect of the gear selector is preparatory A pointer on the gear selector informs the driver, which gear is momentarily engaged. Of course, this pointer is rigidly connected with the shifter cylinder.

Method of Gearset Operation

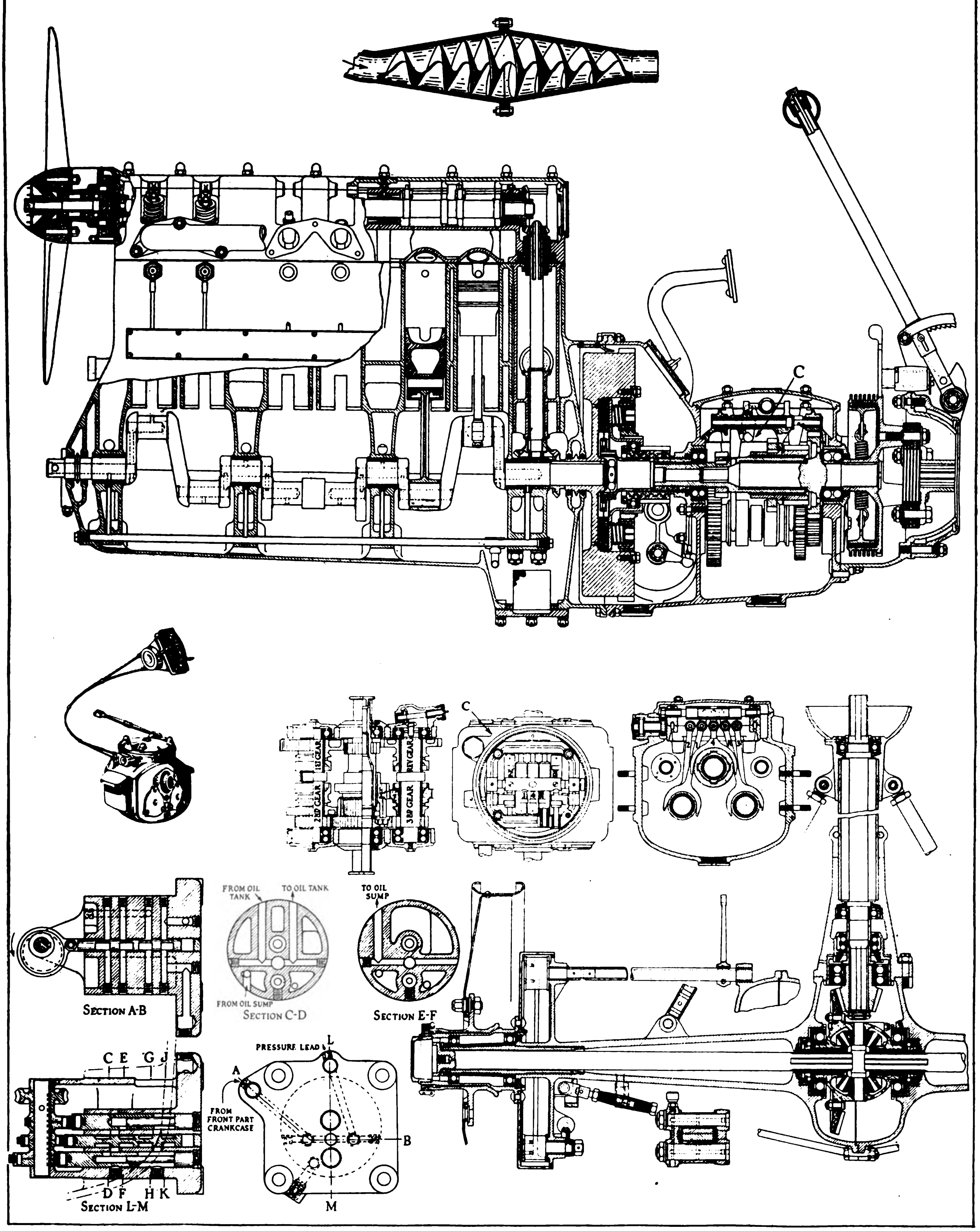
The operation of this gearset is very simple. If, for example, the second gear is engaged, the pointer of the gear selector on the steering wheel stands opposite the 2 on the dial. When the third gear is to be engaged the lever of the gear selector is turned to 3, the pointer's position being unchanged. The change to the third gear is accomplished by depressing and reengaging the clutch, and can be effected at the most favorable moment, a long time after adjusting the lever of the gear selector, without taking the hands off the steering wheel. The pointer only shows the gear actually engaged. After having set the gear selector for a particular speed it is not necessary, for example, to engage that speed. When driving on second speed with the gear selector set for third speed, it is possible to turn the selector lever directly to the idle running position or to any other gear and then engage the corresponding gear by depressing and reengaging the clutch.

The starting motor is arranged on the left side of the gearset, driving through a spur pinion to the toothed rim of the flywheel. The transmission brake is pedal operated, and has internal shoes lined with asbestos fabric. On the outside of the brake drum there are cooling ribs, and a ratchet type sprag is fitted to the brake drum. Only one universal joint is provided, and that of the leather disk type.

Aluminum Alloy for Rear Axle Housing

The rear axle housing is of silumin. See Fig. 6. The rear wheel ball bearings run on steel tubes which are cast in the axle housing and form one piece with it. These tubes extend to a point beneath the rear spring seats, so that the principal bonding moment is not imposed on the silumin housing. The rear axle thrust is transmitted by the propeller tube and two radius rods to a ball head at the rear of the gearset. The drive gears are of the spiral bevel type, and the differential is of the bevel gear type. The rear springs are cantilever type, the rear ends of which are carried between lubricated, ground, steel rollers, fastened to the axle case. Ball bearings are used throughout the rear axle. These bearings are not located directly in the slumin case, but in adjustable steel cages, so that the thrust bearings do not need to be specially adjusted by inserting steel disks, etc. The axle shafts are subject only to torsional stresses, and can be drawn out from the side. The rear wheel brake is an internal type with toggle mechanism. The steering gear is a screw and nut device of rather conventional design. The front wheels can be turned through the large angle of 40 deg.

(Continued on Page 27)



Figs. 4 to 9—At top, Fig. 4, longitudinal section of complete unit power plant including automatic transmission. Center, Fig. 5, sections through transmission. Below, at right, Fig. 6, rear axle with housing of silumin new light-weight alloy. Below, at left, Fig. 7, sections through oil pump. At extreme top, Fig. 8, novel Johest muffler. Left, Fig. 9, Bowden wire selector for transmission gears.

Motor Trucks on Eastern Farms

BY H. R. TOLLEY* and L. M. CHURCH**

Summary of the Farmer's Experience in the Eastern States, Showing the Size of Farms, Size of Trucks, Truck Advantages and Disadvantages

THE experience of farmers who already own and use motor trucks is especially valuable to one who is considering the addition of one of these machines to his farm equipment. In order to provide information of this kind for farmers in the New England and middle Atlantic states, a large number of farmers who were known to own trucks were asked for reports concerning their machines. Each report gave the type and size of the truck, the use made of it, the cost of operation, its advantages and disadvantages for farm use, the owner's idea of its profitableness, and other related information.

Of the reports which were received all were excluded that had to do with secondhand trucks, trucks made by the addition of truck units or attachments to passenger cars, and all that came from men who had owned their trucks six months or less, or used them primarily for custom work or in connection with other business and only incidentally for farm work. This left answers from 753 men, of whom 241 are located in New York, 235 in Pennsylvania, 92 in New Jersey, 63 in Massachusetts, 40 in Maryland, and lesser numbers in Maine, New Hampshire, Vermont, Rhode Island, Connecticut and Delaware.

These men operate farms of all sizes and types, varying from truck farms of only a few acres to large crop farms containing several hundred acres.

One hundred and forty-nine of them are operating truck farms. The average size of these truck farms is 64 acres, and the average distance from market is 12 miles.

One hundred and twenty-nine are operating farms, on which dairying is the principal enterprise. The average size of the dairy farms is 234 acres, and the average distance from market is 6 miles.

One hundred and thirteen are operating fruit farms with an average size of 111 acres and an average distance from market of 11 miles.

Forty-eight are operating crop farms on which general field crops are raised, but where few or no dairy cows are kept and no livestock is raised for sale. The average size of these crop farms is 237 acres, and the average distance from market is 8 miles.

Three hundred and fourteen are operating general farms on which no one special enterprise predominates. The average size of these general farms is 210 acres, and the average distance from market is 11 miles.

The fact that more of the reports are from men who operate general farms than from any other class does not indicate that the percentage of such farmers who own motor trucks is larger than that of men who follow special types of farming, but that in this region, there are more general farms than of any other types.

The motor trucks reported on are of many sizes, ranging from one-half to five tons capacity. However, nearly half of the total number are of the one-ton size, and only about 2 percent are rated at more than two tons.

* Agricultural Engineer. ** Assistant in Agricultural Engineering. Both with Department of Agriculture. Slightly condensed from Farmers' Bulletin 1201.

No attempt was made to determine to what extent income had been increased through the use of the trucks, but 95 percent of the reports stated that the machines bade fair to be profitable investments. So far as could be determined the size of the truck, the type of farming practiced, and length of time the machine had been owned had little to do with the owner's idea of its profitableness. Some who do not consider that their motor trucks are proving profitable, are men who have found them unreliable, often out of order when needed, or expensive to keep in repair. Others have found that they do not have enough work for the trucks to justify investment in such an expensive piece of equipment.

Advantages and Disadvantages

There are many advantages in the ownership of a motor truck, but just how great these advantages are, and which should be given the greatest weight, are questions which the man who has not had experience with a truck cannot answer. The important thing for the prospective purchaser of a motor truck to know is what the men who have used trucks have found to be their principal advantages and disadvantages in actual practice. These motor truck owners were asked the questions, "What have you found to be the principal advantage of a truck for farm work?" and "What is the principal disadvantage?"

The replies to the first question emphasize the following points:

Saving time. Over 90 percent believe that saving time is the principal advantage. The saving of time effected by the truck not only enables the owner to put in more time at work on the farm, but also often enables him to go to a better market, or to get perishable produce to market in better condition than would be possible with horses and wagon.

Saving horses. About 3 percent believed that saving horses is the principal advantage. Long hauls to market over hard roads are more wearing on most farm horses than is farm work. The use of a truck not only relieves the horses of this hard work, but leaves them available for work on the farm while the truck does the road hauling.

Better markets. Only 2 percent consider that the principal advantage of the truck is that it enables them to go to a better market. However, nearly one-fourth of the total number are now selling on better markets than they did before they owned their trucks, and in most cases these new markets are at a considerably greater distance from the farm than were the old markets. Going to a market which is farther from the farm is now simply a matter of taking more time for marketing, and part of the men who consider that saving time is the principal advantage find that the trucks save them sufficient time to enable them to go to the better market.

Convenience. About 2 percent consider that the greater convenience of the motor truck is its greatest advantage.

Reduction of expense. Only 1 percent consider the reduction of expense is the principal advantage.

The fact that such a small number consider the saving of horses, reduction of expense, and greater convenience as the principal advantage indicates that the amount of time which motor trucks will save, which incidentally may result in reaching a better market or in getting produce to market in better condition, is the item which should be given paramount importance by the prospective purchaser.

The answers to the question, "What is the principal disadvantage of the truck?" emphasize the following points:

Poor Roads. This was given as the principal disadvantage by 59 percent of those who answered this question. A large percentage of the reports stated that there is some time during the year when the roads are in such condition that motor trucks cannot be used. The men who live on unimproved roads have the greatest handicap in this respect, but even the best roads in this region may be impassable for trucks because of snow at certain times of the year.

Cost of operation. Seventeen percent consider operation costs the principal disadvantage. The cost of operating trucks of different sizes varied from an average of 8 cents per mile for the one-half ton truck to 20 cents per mile for the 2-ton machine.

First cost. The first cost of these truck varied from less than $1,000 to over $3,000. Five percent of the owners consider that this is the greatest disadvantage. Few of these farmers sold enough horses to pay for the truck, and in most cases the truck represents an added investment in equipment.

Inability to operate on soft ground. Nine percent consider this the greatest disadvantage. A majority of the men reporting use horses and wagon for hauling in the fields and around the buildings, but most of them do not consider the fact that the truck can not be used satisfactorily for such work as its principal disadvantage.

Incompetent drivers. Most of the trucks are driven by the owner or some member of his family, but a considerable number of those who hire drivers consider the incompetency of such drivers as the principal disadvantage connected with the use of the truck.

Mechanical troubles. About one man in 35 says that trouble due to mechanical defects in the construction of the machines is the principal drawback to their use.

The Best Size

That most of these men consider their motor trucks profitable investments does not mean that each is entirely satisfied with the particular machine owned. It is very important that the truck should be of the proper size for the hauling which it is to do. Ordinarily both the first cost and the cost of operation of a small truck will be less than the cost of a large one, but often the small truck will not carry loads as large as desired, and more trips to haul a given amount of material will be necessary than with a larger truck. On the other hand, a truck which is too large would have to be operated with only part of a load much of the time, and the extra cost of operation at these times would exceed the saving effected by being able to carry larger loads on exceptional occasions.

The recommendations of the experienced truck owners who answered the question, "What size do you now consider best for your conditions?" are particularly significant. Experience has caused 64 percent to prefer the same sizes as they now own, 34 percent to prefer larger sizes, and 2 percent to prefer smaller sizes.

The preferences of these men indicate that in most cases the choice of a truck which is to be used primarily for farm work should lie among the 1 ton, 1¼ ton, and 2 ton sizes. Sixty-five percent now own one of these sizes, and experience has convinced 80 percent that one or the other of these sizes is best. The specific size for any individual farm will depend, of course, upon the hauling requirements of that farm.

Distance to Market

The time required for hauling to and from the farm generally is greatest for those farmers farthest from markets, and it is on such farms that most use will be found for motor trucks. The most striking point concerning the eastern farms on which trucks are already owned is their greater distance from market than other farms in the same section. Only 18 percent of them are less than 5 miles from market, nearly 25 percent are 20 miles or more, and the average distance from market of all is about 10 miles.

Probably a majority of all farms in the eastern part of the country are less than 5 miles from market, and comparatively few operators of these near-by farms have as yet invested in motor trucks. The man who is only 2 or 3 miles from his market must have an exceptionally large amount of hauling if he expects sufficient work for a truck to make a profitable investment.

Change of Markets

Many farmers who do not own trucks are using first-class markets, and there are many whose farms are so located that even motor trucks will not put such markets within reach. However, about one-fourth of these eastern farmers who now own trucks have changed since purchasing trucks to markets farther from the farms, and a large majority of them say that the new market is better than the old one.

The men who have changed markets are on an average 7 miles from the markets they used before purchasing trucks and 20 miles from the markets which they now use. Before purchasing trucks 75 percent of them were using markets which were less than 10 miles distant, but now over 80 percent are using markets which are 10 miles or more from their farms. About one-fifth go to markets which are 30 or more miles away.

A somewhat smaller percentage of dairy farmers than of any other type changed their markets. When milk is hauled to a condensary or to a station for shipment it is not often that one market or station is enough better than any other to warrant a change.

The reports do not show the extent to which the use of the better markets has increased the income, but this increase, especially for a truck farmer or a fruit farmer, is sometimes in itself enough to make the motor truck a profitable investment.

Road Hauling With Trucks

On the average it requires only 35 to 40 percent as much time to make a haul of a given length with a truck as it does with horses and wagon. As a matter of fact, the owners of smaller trucks usually haul smaller loads and the owners of larger trucks haul larger loads with their trucks than they formerly hauled with horses and wagons. Consequently the total amount of time which the larger trucks are saving their owners is greater than

that indicated in the chart, and the total amount saved by the smaller trucks is smaller than that indicated.

When hauling crops on the road the average load for the half-ton trucks owned by these men is about 950 pounds, whereas the average load formerly hauled with horses and wagons was 1,500 pounds. The average load of crops for the three-quarter ton trucks is 1,850 pounds, 15 to 20 percent less than was formerly hauled with wagons by the same men. The owners of 1-ton and 1¼ and 1½ ton trucks haul on the average about the same size loads as formerly with horses and wagons. The average load of crops for the 2-ton truck is 4,950 pounds, about 10 percent greater than the load formerly hauled with wagons. The trucks which are larger than the 2-ton size haul loads 30 percent larger than their owners formerly hauled with wagons.

The average loads of all materials (except milk) are approximately the same as the loads of crops for trucks of different sizes and for wagons. Milk on these farms is hauled almost entirely with either 1-ton or smaller trucks. Only 10 of the trucks on the 129 dairy farms are more than 1 ton in size. The average load of milk for the ½-ton trucks is 600 pounds, and for the ¾-ton and 1-ton trucks, 1,300 pounds, and all these men formerly hauled approximately the same size loads with their wagons as they now do with their trucks.

The dairy farmers are also nearer to their markets and shipping points than are the truck owners who practice other types of farming.

Return Loads

The percentage of time which a truck is run without a load has a direct influence on the cost per unit of hauling with the truck. If the farmer can arrange to haul a load of produce to market and bring back a load of supplies to the farm on the same trip, he will reduce the time required and expense for hauling practically 50 percent. The reports of these men show that they have loads both ways for their trucks on an average of about 26 percent of their trips. Thirty percent of the men, however, stated that they never have return loads. The dairy farmers and general farmers reported return loads a considerably larger percentage of the time than did the fruit, truck, and crop farmers.

Road Hauling for Which Trucks Are Not Used

Nearly two-thirds of those owning trucks still used their horses to supplement their trucks in hauling on the road, and 45 percent of the men who reported that they used their horses for some hauling on the road during the year covered by their reports gave poor roads as the reason—that is, hauling had to be done at times when the condition of the roads was such that their trucks could not be used. A majority of the remainder stated that they used their horses either because the truck was too light for the load which it was desired to haul, or because the body of the truck was unsuited to carrying the material. However, no farmer with a truck larger than the 1-ton size stated that he used horses because the truck was too light. About 7 percent of the total number said that they used their horses to help out when the truck was busy, and about an equal number said that since they must keep their horses anyway they used them for some road hauling when they were not busy at other work.

It was not possible to determine from the reports the exact proportion of the hauling to and from these farms which is still done with horses. However, on a majority of them horses were used only for road hauling which it was necessary to do at times when the trucks could not be used or for which the trucks were not suitable, and ordinarily such hauling would amount to only a small percentage of the total.

The Effect of Different Kinds of Roads on Use of Trucks

Poor roads are to most men who own trucks the principal disadvantage connected with their use, and poor roads are why most of them still use horses for part of their road hauling. On the average there were eight weeks in the year covered by the reports when the roads were in such condition on account of mud, snow, etc., that the trucks could not be used.

It does not necessarily follow that horses were always used for hauling when the roads were in such a condition that the trucks could not be used, as on a part of these farms there was no hauling which it was necessary to do at such times.

Twenty-nine percent of these trucks travel usually on dirt roads only, 46 percent on roads that are part dirt and part improved, and 25 percent on roads which are wholly improved. On the average there were 10.7 weeks during the year when the trucks which travel only on dirt roads could not be used, 7.8 weeks when those which travel partly on dirt roads and partly on improved roads could not be used, 3.5 weeks when those which travel solely on improved roads could not be used.

In all, less than 25 percent of the men found it possible to use their trucks every week in the year, and between 35 and 40 percent reported that there were more than eight weeks during the year when they could not use their trucks. About one-half of the men with wholly improved roads stated that they could use their trucks any time during the year, but only 9 percent of those with all dirt roads were able to do so, and there were more than eight weeks during the year when 55 percent of these men with all dirt roads were unable to use their trucks. Snow was doubtless the main factor in making the roads impassable for then men who have improved roads only, but who found that there was at least one week during the year when they were not able to use their trucks.

The kind of tires with which these trucks are equipped apparently has little to do with the time the condition of the roads prevents their use.

Hauling on the Farm With Trucks

A majority of these truck owners still haul in the fields and around the buildings exclusively with horses. The reason for not using the truck for this hauling was not given in every case, but many stated that they do not consider their trucks suitable for such work. The smaller trucks in many cases will not carry as large loads as it is desired to haul, often the truck cannot obtain traction in the fields, and sometimes the body with which it is equipped is not suited to the material to be hauled.

Many others stated that they use their horses for all hauling on the farm because there is no advantage in using the truck for such work. Most of the time required for hauling on the farm is taken up with loading and unloading and the percentage of the total time which will be saved by the truck when used for such work is small as compared with the time it will save in road hauling. When there are horses on the farm which would otherwise be idle, it would naturally be more profitable to use the horses and let the truck stand idle if there is no advantage in time saved or convenience in using it.

(Continued on Page 27)

How Ford Works Out His Assembly*

THE first step forward in assembly came when we began taking the work to the men instead of the men to the work. We now have two general principles in all operations—that a man shall never have to take more than one step, if possibly it can be avoided, and that no man need ever stoop over.

The principles of assembly are these:

(1) Place the tools and the men in the sequence of the operation so that each component part shall travel the least possible distance while in the process of finishing.

(2) Use work slides or some other form of carrier so that when a workman completes his operation, he drops the part always in the same place—which place must always be the most convenient place to his hand—and if possible have gravity carry the part to the next workman for his operation.

(3) Use sliding assembling lines by which the parts to be assembled are delivered at convenient distances.

The net result of the application of these principles is the reduction of the necessity for thought on the part of the worker and the reduction of his movements to a minimum. He does as nearly as possible only one thing with only one movement.

The assembling of the chassis is, from the point of view of the non-mechanical mind, our most interesting and perhaps best known operation, and at one time it was an exceedingly important operation. We now ship out the parts for assembly at the point of distribution.

Along about April 1, 1913, we first tried the experiment of an assembly line. We tried it on assembling the flywheel magneto. We try everything in a little way first—we will rip out anything, once we discover a better way, but we have to know absolutely that the new way is going to be better than the old before we do anything drastic. I believe that this was the first moving line ever installed. The idea came in a general way from the overhead trolley that the Chicago packers used in dressing beef. We had previously assembled the flywheel magneto in the usual method. With one workman doing a complete job he could turn out from 35 to 40 pieces in a nine-hour day or about 20 minutes to an assembly. What he did alone was then spread into 29 operations; that cut down the assembly to 13 min. 10 sec. Then we raised the height of the line eight inches—this was in 1914—and cut the time to seven minutes. Further experimenting with the speed that the work should move at cut the time down to five minutes. In short, the result is this: by the aid of scientific study one man is now able to do somewhat more than four did only a comparatively few years ago. That line established the efficiency of the method of assembly and we now use it everywhere. The assembling of the motor, formerly done by one man, is now divided into 84 operations—those men do the work that three times their number formerly did. In a short time we tried out the plan on the chassis.

About the best we had done in stationary chassis assembling was an average of 12 hours and 28 minutes per chassis. We tried the experiment of drawing the chassis with a rope and windlass down a line 250 ft. long. Six assemblers traveled with the chassis and picked up the parts from piles along the line. This rough experiment reduced the time to 5 hours, 50 minutes per chassis. In the early part of 1914 we elevated the assembly line. We had adopted the policy of "man-high" work; we had one line 26¾ inches and another 24½ inches from the floor—to suit squads of different heights. The waist high arrangement and a further subdivision of work so that each man had fewer movements cut down the labor time per chassis to 1 hour, 33 minutes. Only the chassis was then assembled in the line. The body was placed on in "John R Street"—the famous street that runs through our Highland Park factories. Now the line assembles the whole car.

It must not be imagined, however, that all this worked out as quickly as it sounds. The speed of the moving work had to be carefully tried out; in the flywheel magneto we first had a speed of 60 inches per minute. That was too fast. Then we tried 18 inches per minute. That was too slow. Finally we settled on 44 inches per minute. The idea is that a man must not be hurried in his work—he must have every second necessary but not a single unnecessary second. We have worked out speeds for each assembly, for the success of the chassis assembly caused us gradually to overhaul our entire method of manufacturing and to put all assembling in mechanically driven lines. The chassis assembling line, for instance, goes at a pace of six feet per minute; the front axle assembly line goes at 189 inches per minute. In the chassis assembling are 45 separate operations or stations. The first men fasten four mud guard brackets to the chassis frame; the motor arrives on the tenth operation, and so on in detail. Some men do only one or two small operations; others do more. The man who places a part does not fasten it—the part may not be fully in place until several operations later. The man who puts in a bolt does not put on the nut; the man who puts on the nut does not tighten it. On operation number 34 the budding motor gets its gasoline; it has previously received lubrication; on operation 44 the radiator is filled with water and on operation number 45 the car drives out onto John R street.

Essentially the same ideas have been applied to the assembling of the motor. In October, 1913, it required 9 hours and 54 minutes of labor time to assemble one motor; six months later, by the moving assembly method, this time had been reduced to 5 hours and 56 minutes. Every piece of work in the shops moves; it may move on hooks on overhead chains going to assembly in the exact order in which the parts are required; it may travel on a moving platform, or it may go by gravity, but the point is that there is no lifting or trucking of anything other than materials. Materials are brought in on small trucks or trailers operated by cut-down Ford chasses, which are sufficiently mobile and quick to get in and out of any aisle where they may be required to go. No workman has anything to do with moving or lifting anything. That is all in a separate department—the department of transportation.

We started assembling a motor car in a single factory. Then, as we began to make parts, we began to departmentalize so that each department would do only one thing. As the factory is now organized, each department makes only a single part or assembles a part. A department is a little factory in itself. The part comes into it as a raw

* From McClure's Magazine.

material or as a casting, goes through the sequence of machines and heat treatments, or whatever may be required, and leaves that department finished. It was only because of transport ease that the departments were grouped together when we started to manufacture. I did not know that such minute divisions would be possible; but as our production grew and departments multiplied, we actually changed from making automobiles to making parts. Then we found that we had another new discovery, which was that, by no means all of the parts had to be made in one factory. It was not really a discovery—it was something in the nature of going around in a circle to my first manufacturing when I bought the motors and probably 90 percent of the parts. When we began to make our own parts we practically took for granted that they had to be made in the one factory—that there was some special virtue in having a single roof over the manufacture of the entire car. We have now developed away from this. If we build any more large factories, it will be only because the making of a single part must be in such tremendous volume as to require a large unit. I hope that in the course of time the big Highland Park plant will be doing only one or two things. The casting has already been taken away from it and has gone to the River Rouge plant. So now we are on our way back to where we started from—excepting that, instead of buying our parts on the outside, we are beginning to make them in our own factories on the outside.

This is a development which holds exceptional consequences, for it means, as I shall enlarge in a later chapter, that highly standardized, highly subdivided industry need no longer become concentrated in large plants with all the inconveniences of transportation and housing that hamper large plants. A thousand or five hundred men ought to be enough in a single factory; then there would be no problem of transporting them to work or away from work and there would be no slums or any of the other unnatural ways of living incident to the overcrowding that must take place if the workmen are to live within reasonable distance of a very large plant.

Highland Park now has 500 departments. Down at our Piquette plant we had only 18 departments, and formerly at Highland Park we had only 150 departments. This illustrates how far we are going in the manufacture of parts. Hardly a week passes without some improvement being made somewhere in machine or process, and sometimes this is made in defiance of what is called "the best shop practice." I recall that a machine manufacturer was once called into conference on the building of a special machine. The specifications called for an output of two hundred per hour.

"This is a mistake," said the manufacturer, "you mean two hundred a day—no machine can be forced to two hundred an hour.

The company officer sent for the man who had designed the machine and they called his attention to the specification. He said:

"Yes, what about it?"

"It can't be done," said the manufacturer positively; "no machine built will do that—it is out of the question."

"Out of the question!" answered the engineer; "if you will come down to the main floor you will see one doing it: we built one to see if it could be done and now we want more like it."

The factory keeps no record of experiments. The foreman and superintendents remember what has been done. If a certain method has formerly been tried and failed, somebody will remember it—but I am not particularly anxious for the men to remember what someone else has tried to do in the past, for then we might quickly accumulate far too many things that could not be done. That is one of the troubles with extensive records. If you keep on recording all of your failures you will shortly have a list showing that there is nothing left for you to try—whereas it by no means follows because one man has failed in a certain method, another man will not succeed.

They told us we could not cast gray iron by our endless chain method and I believe there is a record of failures. But we are doing it. The man who carried through our work either did not know or paid no attention to the previous figures. Likewise, we were told that it was out of the question to pour the hot iron directly from the blast furnaces into mold. The usual method is to run the iron into pigs, let them season for a time, and then remelt them for casting. But at the River Rouge plant we are casting directly from cupolas that are filled from the blast furnaces. Then, too, a record of failures—particularly if it is a dignified and well-authenticated record—deters a young man from trying. We get some of our best results from letting fools rush in where angels fear to tread.

The Barred Word—"Impossible"

None of our men are "experts." We have most unfortunately found it necessary to get rid of a man as soon as he thinks himself an expert—because no one ever considers himself expert if he really knows his job. A man who knows a job sees so much more to be done than he has done, that he is always pressing forward and never gives up an instant of thought to how good and how efficient he is. Thinking always ahead, thinking always of trying to do more, brings a state of mind in which nothing is impossible. The moment one gets into the "expert" state of mind a great number of things become impossible.

I refuse to recognize that there are impossibilities. I cannot discover that anyone knows enough about anything on this earth definitely to say what is and what is not possible. The right kind of experience, the right kind of technical training, ought to enlarge the mind and reduce the number of impossibilities. It unfortunately does nothing of the kind. Most technical training and the average of that which we call experience, provide a record of previous failures and, instead of these failures being taken for what they are worth, they are taken as absolute bars to progress. If some man, calling himself an authority, says that this or that cannot be done, then a horde of unthinking followers start the chorus: "It can't be done."

Take castings. Casting has always been a wasteful process, and is so old that it has accumulated many traditions which make improvements extraordinarily difficult to bring about. I believe one authority on molding declared—before we started our experiments—that any man who said he could reduce costs within half a year wrote himself down as a fraud.

Our foundry used to be much like other foundries When we cast the first "Model T" cylinders in 1910, everything in the place was done by hand; shovels and wheelbarrows abounded. The work was then either skilled or unskilled; we had molders and we had laborers. Now we have about 5 percent of thoroughly skilled molders and

core setters, but the remaining 95 percent are unskilled; or, to put it more accurately, must be skilled in exactly one operation, which the most stupid man can learn within two days. The molding is all done by machinery. Each part which we have to cast has a unit or units of its own—according to the number required in the plan of production. The machinery of the unit is adapted to the single casting; thus the men in the unit each perform a single operation that is always the same. A unit consists of an overhead railway to which at intervals are hung little platforms for the molds. Without going into technical details, let me say the making of the molds and the cores, and the packing of the cores, are done with the work in motion on the platforms. The metal is poured at another point as the work moves and, by the time the mold in which the metal has been poured reaches the terminal, it is cool enough to start on its automatic way to cleaning, machining, and assembling. And the platform is moving around for a new load.

Take the development of the piston rod assembly. Even under the old plan, this operation took only three minutes and did not seem to be one to bother about. There were two benches and 28 men in all; they assembled 175 pistons and rods in a nine-hour day—which means just five seconds over three minutes each. There was no inspection and many of the piston and rod assemblies came back from the motor assembling line as defective. It is a very simple operation. The workman pushed the pin out of the piston, oiled the pin, slipped the rod in place, put the pin through the rod and piston, tightened one screw and opened another screw. That was the whole operation. The foreman, examining the operation, could not discover why it should take as much as three minutes. He analyzed the motions with a stop-watch. He found that four hours out of a nine-hour day were spent in walking. The assembler did not go off anywhere, but he had to shift his feet to gather in his materials and to push away his finished piece. In the whole task, each man performed six operations. The foreman devised a new plan; he split the operation into three divisions, put a slide on the bench and three men on each side of it, and an inspector at the end. Instead of one man performing the whole operation, one man then performed only one-third of the operation—he performed only as much as he could do without shifting his feet. They cut down the squad from 28 to 14 men. The former record for 28 men was 175 assemblies a day. Now seven men turn out 2,600 assemblies in eight hours. It is not necessary to calculate the saving there!

Painting the rear axle assembly once gave some trouble. It used to be dipped by hand into a tank of enamel. This required several handlings and the services of two men. Now one man takes care of it all on a special machine, designed and built in the factory. The man now merely hangs the assembly on a moving chain which carries it up over the enamel tank, two levers then thrust thimbles over the ends of the ladle shaft, the paint tank rises six feet, immerses the axle, returns to position and the axle goes on to the trying oven. The whole cycle of operations now takes just 13 seconds.

The radiator is a somewhat complex affair and soldering it used to be a matter of skill. There are 95 tubes in a radiator. Fitting and soldering these tubes in place is by hand a long operation, requiring both skill and patience. Now it is all done by a machine which will make 1,200 radiator cores in eight hours; then they are soldered in place by being carried through a furnace by a conveyor. No tinsmith work and so no skill is required.

We used to rivet the crankcase arms to the crankcase, using pneumatic hammers which were supposed to be the latest development. It took six men to hold the hammers and six men to hold the casings, and the din was terrific. Now an automatic press operated by one man, who does nothing else, gets through five times as much work in a day as those 12 men did.

In the Piquette plant the cylinder casting traveled four thousand feet in the course of finishing; now it travels only slightly over 300 feet.

There is no manual handling of material. There is not a single hand operation. If a machine can be made automatic, it is made automatic. Not a single operation is ever considered as being done in the best or cheapest way. At that, only about 10 percent of our tools are special; the others are regular machines adjusted to the particular job.

Eberhard Will Show Bus in the White at C. B. N. A. Convention

The Eberhard Manufacturing Co., Cleveland, O., will have an exhibit at the C. B. N. A. convention at the Hotel McAlpin, in New York City, October 9 to 13. The following representatives from the company will be in attendance: William Austin, Geo. B. Shepard, John McGrath, C. A. Hennicke, C. R. Hennicke, and H. H. Nelson. There will be shown a large variety of body hardware for both motor truck and passenger cars. One of the specialties will be a bus body of "knock-down" construction shown "in-the-white." It will be trimmed with irons the company has devised for this purpose and will have on the "Emco" door control, folding steps, wind shield hinges, coach hinges, etc. A large line of coach hinges, auxiliary seats, lock handles, etc., will be shown.

Ford Changes

A one-man top, slanting windshield and gypsy side curtains are now regular equipment on Ford cars coming through from the factory and assembling plants. It is understood that the change has been in contemplation for some time and production facilities are now completely worked out.

The slanting windshield in addition to adding to the appearance of the car, gives increased comfort due to the fact that it can be opened and adjusted to any angle at both top and bottom. In making the change in the windshield, it has been possible slightly to change the cowl lines and the rake of the instrument board. No change in prices is made with the new equipment.

First Ore Shipped from Ford Mine

On Aug. 2 the first shipment of ore from Henry Ford's iron mine at Michigamme, Mich., was sent to River Rouge. Five hundred tons are now being sent daily to the Rouge plant, there to be turned into steel for Ford products.

The mine was taken over by the Ford interests a year ago and has been under development since. The mine differs from others in the Michigan iron and copper fields in that the miners walk down and up stairs to and from work, instead of being hauled up and down in cages.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIV SEPTEMBER, 1922 No. 6

Now the Closed Car Show

THIS year, the first of the automobile shows is the closed car show and this has opened and closed in New York with remarkable success. This might have been predicted for it comes at the right psychological time, when the weather is beginning to be cool enough so that people are no longer attracted by the thought of motoring in an open touring car. Moreover, last year's show, a very modest affair in a comparatively small hall was considerable of a success although a few weeks later in the year, and unseasonable to just that extent. Further, the past year has shown a most remarkable trend toward closed cars so that this was about the right time for a show of this character.

In regard to the public appreciation of closed cars, it begins to appear that the sedan is to be the all-year car of the near future especially if very large production of this type of body will bring the prices down closer to the touring model, that is will lessen appreciably the spread between the two. The touring model will always be the standard by which the other models are priced, and so long as there is an even thousand dollars (or more) difference between touring and sedan, the great majority of car buyers will think the latter too high priced regardless of the great difference in the value offered.

To prove that the trend is setting toward more and more enclosed bodies, and especially toward the sedan as the all-year body, it is sufficient to quote a few figures which became available recently. One of the lower priced car makers recently announced that over a couple of previous months, more than 20 percent of the sales had been enclosed cars, and almost three-quarters of these enclosed models had been sedans. Now, one of the highest priced car makers, at present behind on deliveries, announces that more than 70 percent of the entire output is enclosed body models. Here we have the two extremes of the scale, the lower priced forms bought by comparatively poor people, and the very high priced ones, bought only by the wealthy. The percentage seems to show that the latter tend more toward enclosed bodies than the former, which is about as a person would reason it out and which agrees well with our earlier statements anent the spread of costs between touring and sedan (or other) enclosed bodies.

A more recent statement of the N. A. C. C. indicated that this year's closed car production would approximate one-half of the total number of cars, which would give a percentage of approximately 50. Evidently, the higher priced makes will run higher than this, the lower priced cars bringing the average down.

With the enclosed models approaching (or reaching) a 50-50 equality with the open models, it would appear that the industry has grown up to a two-car a year basis, one of these being devoted largely to open cars and new models, the other being restricted almost if not wholly to closed forms. Who knows? This might be an excellent thing for the huge (and still growing) industry. If such an arrangement should work into a permanent and profitable one, it would seem that the closed car show should approximate September first and the open car and display of new models should be moved forward more closely to February or March first.

The C. B. N. A. Convention and Anniversary

ON other pages may be found an account and appreciation of the life and influence, as an organization, of the Carriage Builders' National Association, for which this, its fiftieth anniversary, gives the cue.

Measured by foreign organizations of the same and similar character fifty years old would mean merely the swaddling clothes of infancy. We live faster here, so fifty years in the life of an association, as in this instance, makes it one of the oldest, if not the oldest, trade organization in the land.

The wisdom of its founders made its aims and kept them altruistic. Bartering, price and labor regulation were barred and emphatically "given the gate" whenever, as did occur, the less wise and more selfishly greedy, tried to inject the innovation. A success of that kind would have written finis years ago.

The association is now moribund, it is true, but it is because of evolution in vehicular industry that is irresistible. The motor car is the real carriage of the present and future both for service and elegance of design and appointment. Perhaps it may be called the lineal descendant. The buggy is in the trying position of Jacob when he tried to put it over his father that he was Esau. It is no longer the real and important thing in the vehicle industry. Kismet.

So many former carriage builders of the better grade saw this evolution and went with the tide, that today a directory of the past leaders in the carriage industry will find them registered as autocar makers; and as they were leaders in their old art, its applied principles have put them up near the top in this newer effort. Some believe they are at the top so far as influence in modifying design and form not simply mechanical, is concerned.

We think the account prepared will prove interesting, especially to those who have been long enough associated with the old carriage trade to remember some, if not all, of the incidents in the account we have written.

A Fifty Year Old Association

Outline of the Beginning and Long Life of the Oldest Trade Association in the Country.

C. H. E. REDDING

THE convention about to be held in the Hotel McAlpin in New York City, October 10, will mark the fiftieth anniversary of the Carriage Builders' National Association of the United States.

This aged, but vigorous organization first met Tuesday, Nov. 19, 1872, in the St. Nicholas Hotel in New York City. The meeting was called to order by John W. Britton of Brewster & Co., and Clement (Clem) Studebaker of South Bend, was installed as temporary chairman. Mr. Britton became treasurer, and Charles Richter secretary, both temporary officers.

A committee composed of W. D. Rogers, I. V. Lloyd and Benjamin Bruce was the nominators of the following elected officers:

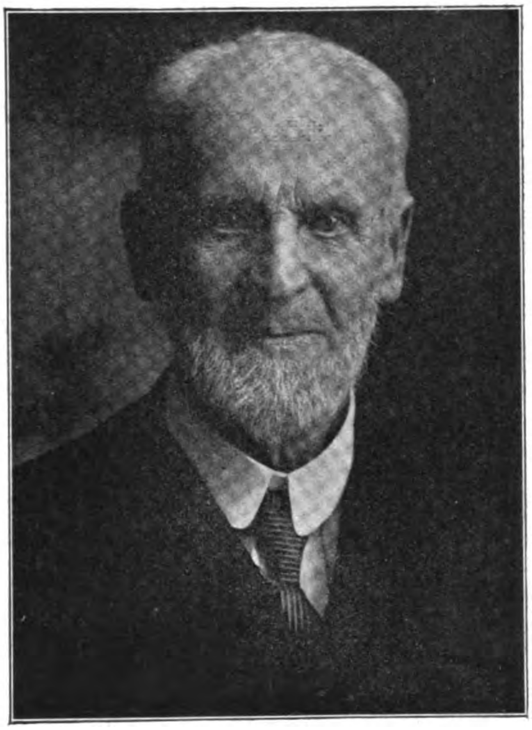
President, Hon. Charles P. Kimball, Maine

Vice presidents, Geo. A. Ainslee, Richmond; John Curtis, Cincinnati; John Green, Wilmington, Del.; Henry Killam, New Haven; R. M. Stivers, New York; James Cunningham, Rochester; Wesley Fallon, St. Louis; F. D. Parry, Amesbury.

Treasurer, John W. Britton.

Secretary, Charles J. Richter.

These names and the circumstances are sketched because they mark the historical beginnings of the society and the character and positions of the men who were glad to come together to form an association that was almost sure of continued success because of the fundamental position taken. (Quoted from the Call, "To prevent any misunderstanding as to the object of this proposed convention, its originators desire to state expressly that it is not proposed to agitate, or even to touch upon, the question of labor and its reward.")



HENRY C. MacLEAR
Secretary Emeritus C. B. N. A.

An interesting fact is that these leaders in the trade remained steadfast to the association aims and gave wholeheartedly of their interest to its success until their business activities came to an end. This is rather an unusual circumstance in an organization.

The Call set forth that "it is desirable for the carriage builders of the United States to meet together in general convention this fall, that we may become better acquainted with one another and form a more perfect union of sentiment and action."

Forty-three firms signed the Call, and it is very interesting to read the names now and murmur, how time changes things, or its latin phrase equivalent if you preter. Here is the list: Abbott, Downing & Co., Geo. A. Ainslie, Joseph Beckhaus, Wm. Bowers & Sons, Brewster & Co. of Broome Street, Geo. L. Brownell, Came Bros., Coan & Ten Broeke Carriage Mfg. Co., Geo. B. Coleflesh, Cooling & Lloyd, Peter Crocker & Son, John Curtis, Chas. F. Dibble, Geo. C. Eliott, Wesley Fallon, Jno. L. Freeman, Gardner & Fleming, Gregg & Bowe, Harvey, Morgan & Co., Hume & Morrill, R. H. Graham, Hugh Johnson, A. J. Joyce & Co., Chas. P. Kimball, Loos & Williams, J. B. McCrillis & Son, McDermott Bros., McLear & Kendall, Geo. C. Miller & Sons, Miner & Stevens, F. D. Parry, T. B. Patten, J. M. Quinby & Co., W. D. Rogers & Co., A. W. Sanborn & Co., O. H. Sargent, Sargent & Nelson, Shaw & Lippincott Mfg. Co., Studebaker Bros. Mfg. Co., R. M. Stivers, A. A. Wheeler, Frederick R. Wood, John M. Young, jr.

There is more than just names in this list. For instance, while Brewster & Co., of Broome Street (accent on Broome Street), was present, there was never anything heard of J. B. Brewster & Co. This calls to mind the most celebrated and picturesque fued that ever was in the carriage trade.

The other outstanding fact is that the signatories were the men of light and leading in the trade. Real carriage builders whose business was an art as well as a vocation, no mere "buggy builders" were thought to be within the pale at the time, and even long after the "buggy builder" wrote "wholesale" in front of the phrase he was not highly regarded except as a mere man, certainly not having a look-in at the "art" of carriage building. It was the aristocracy of the business. This prestige it was that gave the association a momentum that has carried it far.

To this day the "art" of the carriage trade has carried on and become the mind force that has made its impress on the design and construction of that part of the automobile that is not a mechanical job.

The St. Nicholas Hotel in New York City, a very important hotel of the time, was the first meeting place, and there were more than a hundred who answered to the call of the forty.

The Automotive Manufacturer, at that time The Hub, was at the time edited by George W. W. Houghton, an enthusiast in association propaganda and progress, and to whom a debt was acknowledged by the early leaders for his real and efficient aid. The Call was drafted in The Hub office by this brilliant man and editor.

This first meeting shaped the policy of the association. Such men as Mr. Britton and Mr. Kimball were very acute as political managers as well as business leaders, so the organization avoided all stumbling blocks that so often wreck the inception of the best conceived enterprises.

The result of the permanent organization for the first year was the installation of Hon. C. P. Kimball, president; John W. Britton, treasurer; Wilder H. Pray, secretary.

Here were the subjects of discussion at that history-making first meeting.

How Can We Induce Greater Uniformity of "Tracks."

By What Means Can the Present System of Guaranteeing Work Be Improved.

How Can We Mutually Protect Each Other Against Imposition.

The last touched on a tender subject that included false claims, bonuses (tips) to coachmen to keep the job in condition, instead of "queering" it to get the "missus" to buy where the commission to coachmen was more luscious.

This is interesting too as showing the trend of time: "Resolved that thanks be tendered to the three journals, namely, The Hub (now Automotive Manufacturer), The Philadelphia International Coach Makers' Journal (then a journeyman's organ, subsequently The Carriage Monthly, and now Motor Vehicle Monthly), The Harness & Carriage Makers' Journal, (established by the late Mr. FitzGerald).

And today there is not a journal in the carriage (buggy) building field. It has become such a subsidiary interest since the automotive interest has overshadowed the fine vehicle field.

E. M. Stratton, the founder-editor of carriage-trade journals (retired at the time) was present and honored. He suggested a list of the class of work the trade should build.

The second convention also gathered in New York, same hotel. President Kimball in his address made the humorous prophetic allusion, "We find by these bas-reliefs, that the Elamites used, besides these chariots, vehicles drawn by mules, consisting of a flat stage raised upon lofty wheels * * *."

The constitution was adopted. Mr. Kimball was continued as president; Mr. Pray remained secretary.

The third annual meeting was in the same city and hotel, Oct. 21, 1874. By courtesy of The Hub, all the convention reports at the time and for some time after were published without expense to the association. President unanimously continued to hold office, also Mr. Pray.

At this meeting ex-Gov. Hawley of Connecticut, ex-Gov. Bigler of Pennsylvania and A. T. Goshorn, director-general of the approaching "Centennial," appeared and urged the builders to make an exhibit.

The executive committee report had this to say, "The membership has but slightly increased, owing chiefly, it is believed, to the embarrassment of the business of the country."

This foreshadowed the Valley Forge conditions of the C. B. N. A., which were in apogee in 1876.

The fourth annual meeting was held in the Judges' Hall, Centennial Exposition Grounds. When the vote for president was counted (Henry Killam, New Haven, was chosen), the new president received fourteen out of the fifteen votes cast. Things looked blue.

The fifth meeting was in New Haven, Oct. 17, 1877, in the New Haven House, President Killam presiding.

Means were taken to give a new impetus to association matters. The constitution, etc., was doctored. The "initiation" was consolidated with the first year's dues. Again, "honorary members may be elected from any trade or profession upon the payment of initiation fee of $10, and they shall be admitted to all annual meetings, but shall not participate in the proceedings, nor be subject to any assessments or dues."

This let in the "accessory" or associate member, almost entirely recruited from the supply trades, and it became the main financial stay of the organization. By vote, July 19, 1876, honorary members may have all privileges except vote, including annual dinner, by payment of regular annual dues. The dues were, at the time, $5.

The executive committee was reduced to five members, president and secretary, ex officio.

The sixth gathering was in Boston, Oct. 16-18, 1879. The momentum was too much, by this time, for a one-day session. The attendance had mounted to 140. The meeting was lively. This meeting was noteworthy for the unexpected showing of banquet speakers developed from the mass of members. Some of them achieved great subsequent reputation in this difficult art. These names may mean something to readers: Kimball, Killam, Britton, Hale, Jones, Lewis, Scott, Sparks.

Mr. Britton was developed from the most fright-stampeded man before a public audience to a man of distinguished skill as a speaker. Captain John Scott was as good as Mark Twain. Phineas Jones was a convulsive revelation. They achieved stella reputation at one bound and were equal to making good forever after. There were others too, but space is putting on the brakes to reminiscence.

The gathering was at Young's Hotel. In the evening a company of about 75 corralled the band (it was Colt's band from New Haven), marched to the residence of Wm. P. Sargent and serenaded him. This was coming events (in the distant future) casting its shadows before.

This time, the first time, the banquetting room at Young's took on the brilliant environment that was in the future to make these functions so markedly distinguished among trades bodies, that the honor of attendance as a speaker-guest was sought by the most influential. Presidents as our guests were no electric shock, particularly.

The program of entertainment was perfected, after the New Haven episode, by a clam-bake at Revere Beach. It was some bake and time! There was also a visit to Amesbury and Merrimac, then the spot light centers of the coming low-priced buggy furore. We were really invited, also, to a performance at the Boston Theater. Some time!

At the fifth meeting action was taken (the first) to give prizes for technical drawings of vehicles. Prizes were awarded at this meeting. Another established feature making its premiere. Notwithstanding handicaps due to

messing by the national government, the carriage makers were debarred from making the fullness of exhibits intended at Paris, but the honors were brilliant, after all. Score another for community of interest by association work. At this time the observations made in Paris of the supreme importance of a good technical school, were the nucleus of what subsequently was to become the C. B. N. A. School for Carriage Draftsmen and Mechanics, the influence of which lasts to this day, where it is highly appreciated—that is in the automobile body drafting rooms. Some more O tempora, O mores!

The Hub, at this time, by George Houghton, its editor, offered the gold medal of "The Hub Medal of Merit" to be given by the association to draftsmen graduates. Accepted.

The seventh meeting was again held in New York, Oct. 15-16, 1879. The Metropolitan had the honor this time.

Mr. Britton was made president, and it was the tide mark that put the association in its stride. It was now able-bodied. At the banquet were 250, with Hon. Peter Cooper in the seat of honor.

This was the meeting when Lawson Valentine really launched the technical school with his contribution of $1,000, which was repeated in the future as occasion seemed good to him.

The eighth convention marked the invasion and conquest of the west. It was the beginning of the real nationalism, a shuffling off of the swaddling clothes of provincialism. The Grand Pacific Hotel in Chicago, Oct. 20-24, 1880, marked the inauguration of the five-day meeting period, also the recognition of the germ of the "exhibit" feature of conventions, which were to become the marrow in the bone from the point of view of exchequer.

The idea was born of an accidental circumstance and a suggestion by Mr. Redding, then in charge of the business interests of The Hub, and an approval by the secretary, W. H. Pray. For many years thereafter Mr. Redding managed this growing function. It lasted as long as the association itself was important enough to attract it.

At this meeting, with enthusiasm, $4,680 of firms' subscriptions, with single subscriptions of $810, were handed in to establish the Technical School of Carriage Mechanics.

The ninth was held in Cincinnati, Oct. 19, 1881. Mr. Britton continued in the presidency. It was the first year of Frank H. Hooker's incumbency as secretary. These secretarial shiftings are interesting to note because the changes were so infrequently made. The association owed a great debt to the ability of its secretaries. Its successful progress was largely due to their initiative. The membership had now increased to 225, and over $3,000 in the treasurer's fund.

The first report of the newly established Technical School was presented. Prof. John D. Gribbon, the universally esteemed, was in charge. He was succeeded by Prof. Andrew F. Johnson to whose whole-souled service the school was indebted beyond possible recompense other than gratitude. These men were the pillars of the school.

The question of making the annual dues of the associate members $10 was proposed by W. H. Sparks, an associate member.

The active members (the builders) at this meeting established and subscribed $500 to the "Paris Scholarship Fund." This was to send the most promising graduate of the Technical School to Dupont's school for carriage draftsmen in Paris.

At this meeting the Coach Painter, the journal owned by the late Chas. B. Sherron, was recognized as one of the "brotherhood" by the association.

This meeting at the Queen City will be kept vivid in memory as what we would now call the "wettest session" recorded. The redoubtable Mayor Means was with the delegates as a brother; there was no misdemeanor a member could commit, even if so inclined, and on the boat trip down the Ohio to the tomb of President Harrison, there was as much of the original Nick Longworth's wine or the steamer (about) as there was river water under the boat. The river was at very low stage, but the high spirits aboard ship raised everything. Oh, boy! Those were the days.

At this meeting G. H. Burrows, like Capt. John Scott in Boston, developed into a brilliant after-dinner speaker of a highly humorous cast. This gentleman, as a banquet speaker developed two periods, one as above said, the later one as a highly ethical-religious speaker. It was noteworthy and remarked. Hence this reference. At this meeting, also, an associate member-organization developed as a host. The Royer Wheel Co., at that time boss of all the Sarven wheel patents, gave a fine "social" at the Highland on the hill. This was the real, though unofficial commencement of the Accessory Trades Association of the C. B. N. A. becoming the hosts at conventions, as far as the lighter and gayer functions were in question. The stream of Pactolus never did run dry thereafter. It still trickles, but in no such stream as in the Golden Age of the Association.

At the tenth convention, Philadelphia, 1882, Henry C. MacLear, present secretary emeritus of the organization, was chosen president. This was one of the finest meetings ever held. The personnel was then at the top notch of its quality. It had not deteriorated yet. The banquet was in St. George's Hall and was brilliant. Henry Mulliner, the distinguished English coachmaker, representing his guild, was present. Nearly 400 participated. The speakers were of the quality of Hon. W. D. (Pig iron) Kelly, A. Louden Snowden, Chas. Emory Smith, Sam J. Randall, Hon. Isaac H. Bailey, etc. But the association's "own," as usual, took the speaking honors. The addresses of Isaac Bailey and Phineas Jones were "corkers" for sense and sentiment garnished with side-splitting wit and humor. It marked high water in such functions. There was lots of complimentary entertainment.

At the eleventh session held in New Haven, the Carriage Monthly made its bow with its "daily" convention report in its hand. Subsequently this became a feature of the proponents, and a credit to their enterprise.

The twelfth annual convention was noteworthy in a curious fashion. After being invited to St. Louis the previous year, by the trade and the natives, the Free-Silver-Bryan rucus loomed on the business horizon, and in October (the time to hold convention) the country was "all tore" up over politics, and business scared to paralysis. Hence the hosts got a highly developed case of what now would be known as "cold feet," and plead with the executive committee that the convention be skipped this one time, etc.

President MacLear, and a few more of the courageous, firmly against a break in continuity, decided that a meeting must be held, though it would be necessary to forego

the usual exhibition of carriage parts, etc. It was so held Oct. 15, 1884, in Mercantile Library Hall.

The total membership had now grown to 700, and there was more than $4,000 in the bank. The organization was close to its apex of membership and prestige which was to mark the beginning of the decline of the association.

The fourteenth meeting was in New York and was chiefly notable for electing Clem Studebaker as president, who along with his other suitable abilities for the position introduced the slogan, "no wine at the banquets." It was a joke—at first, but Mr. Studebaker finally, after a few years, gained a partial victory, and some of his followers put it over entirely, even before the witch burners and the hypocrites for money only arrived. Mr. Studebaker also marked the beginning of the makers of the "cheap buggy" in affairs of the association.

The old leaders were now gradually being called to the last accounting, so the personnel marked the beginning of the gradual change from the master carriage builder to the wholesale buggy manufacturer. The difference of an art product as against something produced like coal or beans. August, 1886, marked the death of John W. Britton, than whom no dozen men in the association had such a salutary influence over its well-being. Ex-secretary Wilder H. Pray also passed over, likewise James Cunningham and John C. Goold. It was a year to be sorrowfully remembered.

At the Washington convention, 1887, Hugh Johnson was made president, and Henry C. MacLear was elected secretary, a position he has held down to the present.

Here perhaps is a fitting place to write a brief appreciation of this last of the "old guard" of high-grade carriage builders, whose enthusiasm for and devotion to the progress of the art of carriage building has compelled him as a duty as well as a pleasure, to carry through and stand by the association. That his quality as a man, enthusiasm as a trade partisan, and devotion to the C. B. N. A. has met with the appreciation of the personnel, can no better be made evident than by his continuous incumbency of the secretarial office. Until his years and the state of his health unloosed his hand, he was an almost night and day worker for this love of his later years. That he was prized and appreciated cannot be better shown than by his election to secretary emeritus, the final and lasting honor that he can receive.

There followed conventions in Atlantic City on "Million Dollar Piers," and at other cities in succession, until the forty-third convention was scheduled for Cleveland, Sept. 21, 1915.

This marked the last large meeting, also the decline of the association. The automobile had become the octopus that was squeezing the once strong, now puny buggy builder.

The exhibition of carriage parts was the last large show; thereafter some large room or rooms in a hotel, as witness this year, became plenty large to supply all the activities of the organization. The membership has naturally gone the same road as the exhibits. A greater part of the trades accessory to buggy building have become accessory to automotive building. The end will be gradual and not unexpected. The Spirit of the Times is as potent now as it was when Stephenson's locomotive pushed aside the mail coach.

This Spirit of the Times has been the force that has pushed men formerly strong in the carriage industry into the broader and expanding field where talent finds scope. Among them names like Brewster, Cunningham, Studebaker, Durant, Dort, Moon and others less conspicuous in the trade at the time of shifting, but with the vision that marks the man not hidebound. Such mark the real carriage trade evolution.

But nothing can decrease the memory of the past glories of the Carriage Builders' National Association of the United States, and perhaps the ghosts of the past will be gathered in spirit to help celebrate this, its fiftieth anniversary.

And Still the Price Cutting

Shortly after the first of September one of the most prominent of the low-priced car makers announced a small cut in the price of his product, and a considerably larger one on his medium-priced vehicle. This was followed quickly by a cut made by another maker with a car in the $1,000 class and another in the $1,500 group. Both of these reductions were small but as they followed two previous reductions during the year, the sum total is considerable.

As these makers between them will account for an output of a quarter million cars this year, they represent a fair sized section of the total output. And there is considerable trade gossip to the effect that several other cuts are to follow. Many makers who will not actually cut the price are doing the equivalent thereof by adding accessories and equipment which have never before been put on the cars to next year's models.

This putting in extra value may be superior to cutting prices and disturbing the settled status of the various makes, and with it, settled selling plans of considerable magnitude. On the other hand, it keeps the car in a higher price classification, and thus, in one which buyers are less numerous. It is a situation well worth the best thought of the leaders of the industry.

Report Ford Management Being Reorganized

It is reported that Henry Ford is to reorganize. Charles Sorenson, in charge of River Rouge plant, is about to step out. Leo Hurst, for many years head of the drafting department, and James Miller, head of the foundry department, have left and joined General Motors Corporation.

The state of disorganization is said to be largely responsible for the shutdown, and has resulted in determination by Ford to take a more active interest in business. For the past year or more he has left the management of his company to assistants.

Ford Production Figures Out

Production of the Ford Motor Co. for the first seven months of this year, exclusive of Canadian company, was 688,028 as against 554,727 in the same month last year. July domestic production was 136,646 cars and trucks, compared with 114,901 in June and 112,185 in July, 1921. Production at six foreign branches during July was 6,539, as against 6,876 in June, 7,170 in May and 6,100 in July a year ago. Tractor output at Rouge was 9,657 in July and 9,333 in June. Cork plant made 220 tractors in July and 298 in June.

British Motor Trucks for Builders and Contractors

Various Forms of Vehicle Bodies Which Save Time and Labor, and Thus, Cut the Cost of Doing Contracting Work

CONTRACTORS' work is very similar in all countries. so American contractors will find much of interest in some of the truck bodies which British builders have found to be of advantage. Similarly, motor truck manufacturers of heavy vehicles reaching this trade may note something of interest in the following notes and accompanying sketches.

In deciding what classes of vehicle and body are most suitable for use in the building trade, one has many points to consider. In taking the subject broadly, there are not only the builders' requirements to be studied, but there is also the convenience of those who supply materials to the building and allied trades. In the case of the contractor who supplies a certain class of material, and that one only, there is not much difficulty, as he knows exactly his transport requirements and can have a body designed to be the most suited to the particular class of material he deals with. In the case of the builder, the class of vehicle and body most suitable is a far more difficult thing to decide. We propose to deal with the two classes separately.

Choosing Builders' Vehicles

The transport necessary in the building trade is so varied that no hard and fast lines can possibly be laid down, says Commercial Motor, London, and no one vehicle will ever fill the bill exactly. In some cases, comparatively light loads are required to be delivered with great speed to save a stoppage of work, while in other cases heavy loads with no particular time limit to their delivery are required to be moved. Long girders may be carried one day, sand or ballast another day, while on the next day the load may consist of pots of paint and small articles. For the general purpose vehicle the 3-ton gasoline vehicle is undoubtedly the most useful, bricks and timber, however, calling for vehicles of 4-ton capacity.

In selecting a suitable body for this particular trade, the first thing to decide is: Shall it be a tipping body or not?

That there are cases where the tipping body is useful there is no doubt, but it is not absolutely essential, and, therefore, it is not wise to sacrifice other useful points to the ability to tip a load. If a tipping body is decided upon the following points should not be overlooked.

The body should be of ample size, and the sides should be hinged at the bottom, so that any load can be taken off at either side, and, of course, at the back as well. It is also advisable that the sides and tailboard should be connected to the platform by hinges with pins, which can be withdrawn if desired, as in some cases, their removal is necessary where a bulky load has to be carried.

A bolster should be fixed behind the driver's cab for carrying long lengths of any material. The uprights must be fixed and have a horizontal member connecting them for rigidity, and a second member which can be raised or lowered, as may be required. Should a tipping body be fitted, it will not require the removal of the bolster, which should be a permanent part. In some cases it is convenient to have brackets fitted to the bolster, so that any long article, such as poles, can be carried on the outside of the body without interfering with anything that may be carried on the body itself. This device is often very useful. Sometimes the forward bracket is mounted on the cab, and raised so that the poles are sloped, as in Fig. 5, and sometimes on practically the same level as the rear bracket, as in Fig. 4. The former is the better, as access to the engine is not interfered with by the articles thus carried.

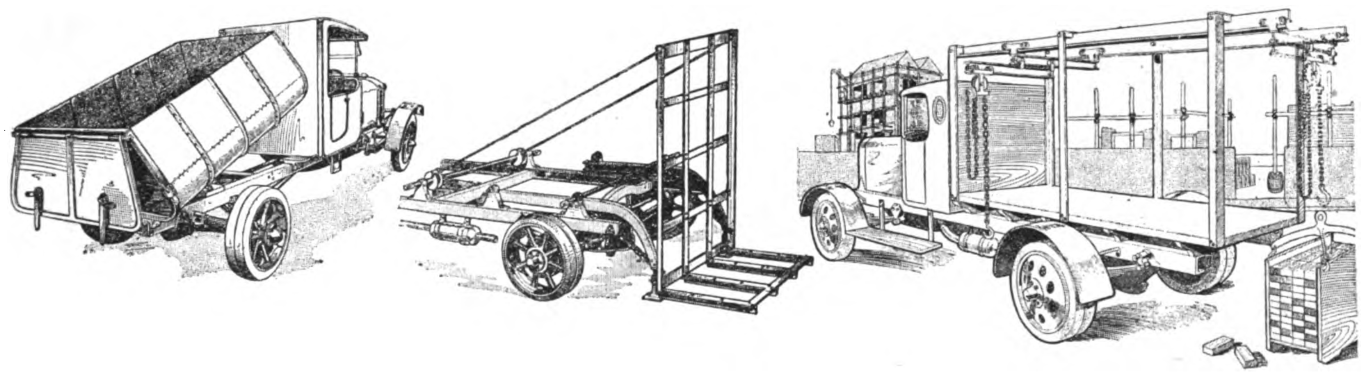


Fig. 1 (left) A type of unbalanced tipping body not always to be recommended as the whole of the load must be raised when it is required to tip. Fig. 2 (center) A device for backing under a raised platform carrying stacked bricks and for tilting them on their sides for transportation purposes. Fig. 3 (right) Truck with overhead hoist and capacity for a number of skips for handling bricks.

The tipping body, in which the power of the engine is used, is a rather expensive appliance, and it is doubtful whether, in the case of a builder, it is worth its cost. The tipping body in which the center of gravity of the load has to be raised, as in Fig. 1, seems to involve an unnecessary waste of power, and, in cases where it has to be operated by hand, it is very doubtful whether there is much advantage in its use. Costly hydraulic and mechanical appliances are made to do this work, which can very well be done by gravity alone, as will be shown. For the use of builders solely there is no need for a body that will tip sideways as well as to the rear.

In our opinion, the most suitable body for this particular purpose is one in which the platform is low and the tipping can be done by hand power without raising the center of gravity to any appreciable extent. The type of body in which the load can be discharged without altering the center of gravity to any extent is simply a flat body when the sides are removed. It is no higher than is

necessary to give a reasonable clearance above the wheels. It can be operated easily by one man, as all that is necessary is to wind the rear rollers so that the body, which rests on these rollers, runs backward far enough to begin to tip. When once on the tip, it can be lowered gradually by means of the wire cables which wind on to the drum. The roller supports the body in the forward position. The line is the line along which the center of gravity moves. The action of this tipping arrangement is that rolling contact takes place between the body and the curved members which are attached to the frame at the rear. Chains attached to the frame at one end and to the body at the other end prevent any slewing round or uneven movement of the body while tipping. This arrangement allows the body to assume a vertical position, so that any load, no matter how sticky, will be completely discharged.

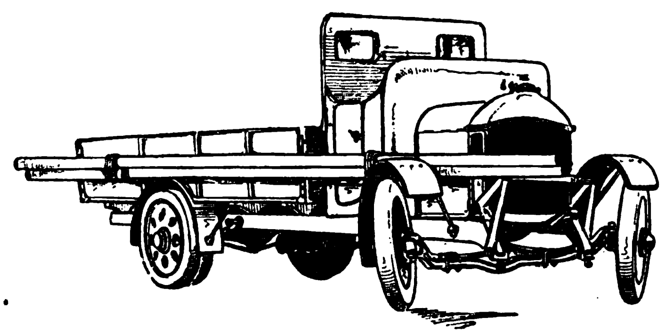
Bodies for Contractors

The requirements of various contractors who supply materials to the building trade are so widely different that it would not be profitable to our readers to pursue the subject too closely. In the matter of tipable materials, the body mentioned above is worthy of consideration. For certain loads which might be piled in stacks, such as debris which has been removed in cutting through a hill. This, like the load, is usually of a kind which can be tipped.

In many cases rear tipping is not desired, and then side tipping becomes essential. The universal tippers, although very efficient, are costly, and it is doubtful whether they will not be found too high in first cost for the purpose under consideration. For road construction nothing is better than the two or three compartment side-tipping forms. When well built of sheet metal, these are simple, strong bodies and require no power for tipping purposes, this being accomplished by hand. They can be, as stated, of two or three compartments.

A road builder may have to carry other things than road ballast, etc., so it is essential that his outfit should include some vehicles with flat bottoms, which although they should be able to tip if required, can carry the heavy plant which now is being used in road construction. The use of stone-breakers, cement mixers, pneumatic jumpers for breaking up concrete, and the compressors and their engines, etc., is becoming more general, so that suitable vehicles for carrying these articles should form part of the outfit.

As to the vehicles themselves there is not much reason



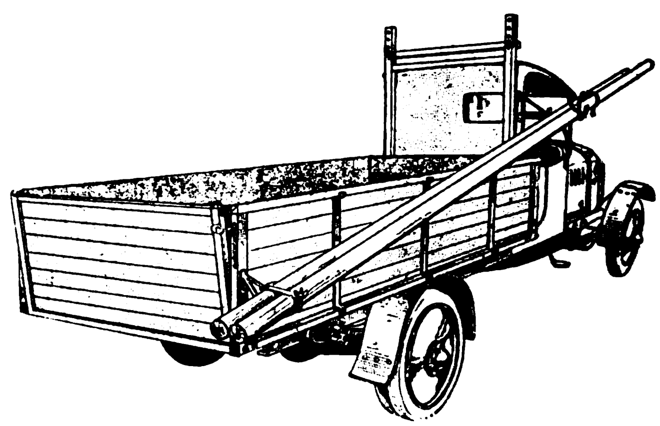


Fig. 4 (left) Sometimes the forward bracket is attached to the dash and on the level of the rear bracket. This permits free access to the motor. Fig. 5 (right) Outside brackets, the forward one attached to the bolsters, are frequently used for carrying long articles.

tiles, slates and bricks, etc., the device reproduced in Fig 2 might be worth considering. This can be backed up to a stack of bricks piled upon a raised platform; the frame is backed under the platform, and the whole stack is lifted and tilted forward until it rests on its side.

In the case of bricks, etc., which are loaded in skips, there is nothing much to be said if a crane can be relied upon at the destination which can pick the skips up and lower them to the place required. This appears to be a method which is being largely adopted, and is obviously a great saver of time. If, on the other hand, a crane cannot be relied upon the device reproduced in Fig. 3 should be useful. In this arrangement a light gantry, just strong enough to lift a skip of the required weight, is arranged so that any of the skips (of which 8 to 12 can be carried by one vehicle) can be lifted just sufficient to clear the platform and swung clear and dropped at either side or at the rear.

Bodies for Road Construction

As nearly all materials for road construction are those which can be conveniently tipped, it is as well to regard a tipping body as being the only one worth considering for this purpose. Not only are materials brought for road making, but, in some cases, it is necessary to cart away

why they should differ from ordinary vehicles excepting in the following points dictated by general experience:

It is believed by some of the most experienced users of such vehicles that a chain drive is the most suitable for such a purpose for several reasons*. The chain-driven vehicles seem to have a power of getting out of holes better than axle-driven trucks. This coupled with the fact that they have a higher clearance, should make them the best for the purpose, as in all building and contract work rough roads and clay holes have to be negotiated frequently.

It is well that the wheelbase should not be too long and there should be a good deal of lock on the steering, as awkward corners have often to be negotiated. A few easily attached spuds for the rear wheels are of great use, and should always be carried on a job where they are likely to be needed. Hooks should be fitted to both front and rear of any vehicles for building work, as one never knows when they may be useful either for towing some other truck out of a difficulty or for being towed out, or even for certain classes of hoisting work.

The way these hooks are generally arranged is not good for the frame so far as the front is concerned. The rear hooks can be fixed in any convenient manner, as there is

* The best American practice scarcely agrees with this opinion.

usually a strong cross member at the back of the frame. The front is different. In many cases, the dumb irons project in front of the cross member, and any sideways pull will have the effect of bending them. It is common practice for drivers and others to put a rope through both hooks and form a triangle of it. This has the effect of pulling the hooks in towards each other. If dump irons are used they should have a strut across to prevent this from happening.

Extra heavy and large loads can best be dealt with by steamers**, to which the above remarks apply equally well. For some classes of load, the six-wheeler of the Scammell type should prove extremely useful.

** These are peculiar to England, as steam trucks are not used in other countries.

New Features Motor Trucks on Eastern Farms

(Continued from Page 12)

All joints are lubricated by grease cups, the front wheel hubs run on ball bearings and the steel disk wheels are detachable.

A Pallas fuel feed device is placed on the dashboard. Fuel is delivered from the rear main tank to the carburetor through the front auxiliary tank. The front tank. of about 10 gal. capacity, is always filled, which is of importance in driving in mountainous districts where long upgrades may be encountered. From the auxiliary tank the fuel flows by gravity to the carburetor.

Szawe cars are fitted with the "Johest" muffler, a patented design that is said to be very efficacious (Fig. 9). The sectional view of this muffler shows it to consist of a double cone shaped case, containing a sheet metal helix leaving a direct opening at the center. This helix varies in pitch and diameter from the ends toward the middle The exhaust gases entering at one end flow partly through the central opening and partly through the helical passage. The larger part of the exhaust gases is subject to continuous expansion in the radial and axial directions, on account of the varying diameter and varying pitch of the helix. The result is said to be that the gases leave the muffler at a uniform pressure greatly expanded. This muffler is claimed not to give any detrimental back pressure to damp the noise and cannot be clogged.

The following data relating to the Szawe chassis is of interest:

Wheel base ....3,475 millimeters (137 in.)
Tread ....1,400 millimeters (55 in.)
Tires (front and rear) ......880 x 120 millimeters (37 x 5)
Turning diameter ....12 meters (40 ft.)
Seating capacity ....6 persons incl. driver
Weight of chassis (without fuel).850 kilograms (1,870 lb.)
Speed ....100 kilometers 1 hr. (62.5 m.p.h.)

At the first German automobile show, held approximately a year ago, it was noted that 80 percent of the automobiles were of the four-cylinder type, so that in respect to number of cylinders this machine is of the minority. Of the 90 models at that show, all but the four having 75 brake horsepower or more developed their power (maximum) at 2,000 to 2,600 r.p.m., with the average just slightly below 2,300 so that Szawe is almost exactly at the average point. Other features such as length of stroke, four speeds, steel cylinder liner, number and type of crankshaft bearings, agree equally well, or perhaps, as in the case of the length of stroke, go slightly further than the average.

Post-War German Car Shows Many Unusual

(Continued from Page 16)

The men who reported that they use their trucks for some hauling on the farm stated that most of such hauling is crops and fertilizer, including lime and manure. The average length of haul reported was about 150 rods.

The saving of time was given by 64 percent of these men as the reason for using their trucks in preference to horses. A truck will save some time over horses on hauls even of this distance if the truck body is suitable for carrying the material to be hauled and if there is no difficulty in obtaining traction in the fields. It may also save time to use the truck when only one or two loads are to be hauled and the horses and wagons are not ready for use.

Eighteen percent reported that they use their trucks for some hauling on the farm because a truck is more convenient than horses and wagon. When frequent stops must be made, or when the vehicle must be left without attention for a considerable length of time, it may be preferable to use the truck even though the horses remain idle and no time is saved by use of the truck.

Eleven percent used their trucks because all the horses were busy at the time.

The men who do use their trucks for hauling on the farm reported hauling only an average of 45 tons of crops and 37 tons of fertilizer per year (including lime and manure) with them, while the average amount of crops hauled to market per year with trucks for all the farms is 119 tons, and the average amount of fertilizer hauled on the road with trucks is 55 tons per year. Thus even the comparatively small number of men who use their trucks for hauling on the farm still use their horses for a goodly share of such work.

Custom Work

A considerable number of farmers have purchased trucks primarily for doing custom hauling and only incidentally for work on their own farms, but such use of a truck is really an enterprise separate from the operation of the farm, and no reports of men who are using their trucks in this way are included in the 753 which form the basis of this bulletin.

However, the man who purchases a truck simply as an addition to his farm equipment may find it possible and profitable to do some custom hauling for his neighbors. About 28 percent of the men who reported on this item stated that they did some custom work during the year covered by their reports. The average amount received by the men who did such work was $174.

About 30 percent of these men who had done custom work stated that it had not been profitable. Many of them stated that the main reason for doing custom work was to accommodate their neighbors, and in such cases the price was often not high enough to make the work profitable.

Most of the custom work reported was done by men owning large or medium-sized trucks. Only seven of the men who own half-ton trucks reported that they did any custom work, and the average amount received by the seven for the work which they did during the year was fifty-three dollars.

(To Be Concluded)

Protective Values of Coatings for Wood*

BY CORNELIUS T. MYERS

ABOUT two years ago the author, in carrying on some research work on wood wheels, had occasion to make inquiry among paint manufacturers as to the value of various kinds of paints and primers for the protection of wood against moisture. This inquiry brought out so many differences and variations in opinion as to paint materials and mixture proportions that a more extensive inquiry among paint men was started. It revealed that:

(1) There was comparatively little technical information to be gained from the paint industry on the relative protective values of different coatings for wood.

(2) The paint industry did not generally recognize the moisture-proofing of wood as a problem, but was concentrating so far as the more reputable manufacturers were concerned on producing paints that would last as long as possible on the surface to which they were applied. In other words, such improvements as have been made have contributed to the life of the coating rather than the life and usefulness of the article which received the coat.

Wood is said to be oven-dry when continued oven drying causes no further loss of weight. In their green state the woods used structurally have a moisture content of 60 to 120 percent of their oven-dry weight and weigh roughly from 60 to 120 percent more than when they are in an oven-dry state. In other words, 35 to 55 percent of the weight of a green log is water. In the green log this water exists in two conditions:

(1) Minute particles of water in each tiny wood cell cavity, known as "free water."

(2) The moisture absorbed by the fibrous material which forms the walls of the cells, known as "hygroscopic moisture."

Felled wood exposed to average atmospheric conditions gradually dries, the air taking up its moisture. First the cell cavities slowly give up their moisture. The evaporation goes on until the cell cavities are emptied of the minute particles of "free water" they contain. All that remains is the moisture actually absorbed by the fibres of the cell walls, which are still saturated with the "hygroscopic moisture." Wood in this state is said to be at its "fibre-saturation point." Up to this time the wood does not appreciably change in size or in physical characteristics except as to weight, which of course decreases considerably as it will now contain but 25 to 30 percent of moisture instead of 60 to 120 percent.

Further drying of the wood is necessary in order to increase its strength, hardness and durability to enable it to take and hold paint, and in general to improve its condition for the purpose intended. As this drying progresses beyond the fibre-saturation point, the cell walls give up the moisture they have absorbed, and in so doing they shrink and harden. Under natural conditions this drying process will continue until the amount of moisture in the wood bears a quite definite relation to the average humidity condition in the particular locality. In the eastern and north central states, for instance, the moisture content of wood will become stabilized somewhere in the neighborhood of 14 percent for what is known as thoroughly air-dried stock. Of course unpainted wood that is exposed to rain and snow will absorb considerably more than 14 percent, depending upon the dimension of the piece and the extent of the exposure.

Forest Products Laboratory Data

Data secured from the Forest Products Laboratory of the United States Department of Agriculture show that:

(1) Many woods should be dried to about 8 percent moisture content to give the best results as to strength, durability, hardness and finish (see table 1).

(2) It is also true that if after being dried, and shrinking in the process, wood reabsorbs moisture, it will swell again according to the amount absorbed.

(3) The shrinking and swelling along the grain, perpendicular to the grain and tangential to the grain all differ, and very materially, for a given change in moisture content. (See table 2.)

TABLE 1. APPROXIMATE PERCENTAGE OF INCREASE IN STRENGTH OVER GREEN[1]

	Dried to 14 per cent moisture	Dried to 8 per cent moisture
Bending strength, modulus of rupture	40 to 60	80 to 100
Compression parallel to grain	80 to 90	100 to 150
Compression perpendicular to grain ..	65 to 75	
Stiffness modulus of elasticity	20 to 30	25 to 35[2]
Hardness	30 to 35	40 to 50[2]
Shearing strength, parallel to grain .	40 to 50	60 to 70[2]

[1] Compiled from data given in Timber, Its Strength, Seasoning and Grading, by H. S. Betts. [2] Estimated.

TABLE 2. SHRINKAGE AND MOISTURE CONTENT OF HARDWOOD[1]

	Specific Gravity of Dry Wood	Shrinkage[2] in Percent of Green from Green to Oven Dry		Green Moist in Percent of Dry Wood Wt.
		Radial	Tangential	
Ash, white[3] .	0.57	4.8	7.0	39
Birch, yellow[3]	0.55	7.4	8.9	68
Elm, cork	0.57	4.8	8.1	53
Hickory[4]	0.64	7.2	10.9	60
Maple[5]	0.51	4.2	8.5	63
Oak, red[5]	0.56	3.9	8.3	83
Oak, white[5] ..	0.60	5.3	8.8	66
Average	0.57	5.4	8.6	62

[1] Compiled from data given in Kiln Drying of Lumber, by H. D. Tieman. [2] Average shrinkage along the grain, up and down as the tree grows, is only about ½ percent. [3] Average of 2 species. [4] Average of 9 species. [5] Average of 3 species.

From the two following tables it will be seen that it is quite desirable to have wood thoroughly dried, and that steps should be taken to keep it so. But although it is easy to reduce the moisture to 8 percent in dry kilns, it is difficult to maintain the wood at this point; because of unsuitable protective coating, or processes, and because of the lack of knowledge as to relative ability of various coatings to stabilize moisture content within a small range.

While we know that several coats of good paint may give adequate protection for floors, truck bodies, wheels or other wooden parts, we by no means know what paints give the best protection or what paints will give fairly satisfactory protection for the least money. The test fences where many different paints were exposed to the same atmospheric conditions, have given some data on the durability of paints, but very little data on the durability of the painted article or its dimensional stability. In durability and dimensional stabilization we are greatly nterested; in the first for very obvious reasons, in the second because wooden structures are more durable, serviceable, and can be made more simple if their various component parts do not expand and contract with changing weather conditions. The cost of drying could be re-

* Condensed from a paper by Cornelius T. Myers, in Mechanical Engineering, Aug., 1922.

duced in many cases, if when dried to a certain point the moisture content could be stabilized. Wood, on account of its very valuable characteristics, could be used in places where metal now seems necessary. A dozen or more prominent concerns in the paint industry have been co-operating commendably in research work, realizing that the dimensional stabilization of wood by moisture-proofing is a proper function of paint and of world-wide importance. There is, however, quite a difference of opinion among these manufacturers as to what materials should be used, and how they should be mixed and applied. During the war the Forest Products Laboratory investigated the moisture-proofing effects of linseed oil and various paints, varnishes and leaf-metal coatings as applied to airplane propellers and other airplane parts made of wood, but this work has not been broadened because of lack of funds.

In order to get some comparative data on the paints and primers now on the market, tests have been made on small hickory, oak, birch and maple by paint concerns.

In general, the results of the tests showed that paints of the ordinary brands and formulas were not very effective as moisture-proofing agents, even when three coats were applied. One paint concern after testing its standard brands did a little experimenting, and without much difficulty was able to produce a special primer that was several times as effective. There was great variation in effectiveness of paints used. Averaging the results for hickory, oak, maple and birch, it took about six times as long for these test pieces to absorb an extra 6 percent of moisture when coated with the "special" as when coated with the standard "A." There is every reason to believe that much better results can be secured and with less than three coats. Preliminary tests with a casein solution indicate that it has water-proofing qualities, which, for some classes of protection, may be very valuable. The same is true of some of the pyroxalin compounds. Varnishes are in general more effective than paints, but in the protection of wheels their application was unsuitable for primary coats.

Flooring, decking, paneling, etc., would be greatly benefited if it did not "work." Many wooden structures would be simpler and more permanent if so protected, and with thoroughly dried timber they would either have a greater factor of safety or could be built with less lumber. Many other advantages will develop as thought is given to the dimensional stabilization of wood by rendering it moist-ture-proof to some substantial degree.

It is well known that shingles and weather boards fastened with old-fashioned wrought-iron nails stay tight much longer than those in which the modern steel nail is used. The reason for this is that the steel nail rusts and is flaked off by the movement, or "working," of the piece through which it is driven. A nail tightly driven is practically sealed against external moisture by its head and the paint around it; but if moisture reaches the nail by the capillary action of the wood fibers, it will rust in spite of end sealing. Then too, the moisture and capillarity of the wood cause the "working" that rubs off the layer of rust and exposes the nail to continuous corrosion. The working also abrades the wood and leaves the familiar large, rust-stained hole around an attenuated nail. The same conditions apply to the bolts and other steel fastenings in farm machinery, wagons, motor-truck bodies, and a long list of other articles. It is of vast importance in wood construction, therefore, that we have paints to protect the wood from absorbing moisture. Ordinary paint does not effectively do this except when a large number of coats is applied, and so far as the writer has been able to find out, there has been little or no attempt to produce a paint that will do it. There seems to be a great possibility for economies, either by the use of cheaper paints which give protection, or paints which will last longer.

Paint literature of a technical nature is quite inadequate to explain the why and wherefore of much present practice. Great differences of opinion and some vague reasoning appear. Many contentions seem to be based on a desire to use certain materials or formulas, rather than on comparative service data of a reliable sort. The Engineering Foundation has approved the desirability of research on this subject and has appointed a committee to report ways and means of furthering it. This is a most substantial endorsement. The Society of Automotive Engineers and the American Institute of Architects have also approved and will lend their support.

The Forest Products Laboratory is by all odds our most authoritative source of information on woods and their structure. The director and his staff have been interviewed and fully agree that this research would be productive of important results, some of which could be expected in the course of 8 to 12 months; also that it can be handled there if funds in a very modest amount, between $10,000 and $20,000 per year, were made available for, say, from five to ten years. The Bureau of Standards has a paint division and has funds to work on the paint end of the research. Doubtless a co-operative arrangement could be made between these two of the most capable and helpful arms of our governmental service.

There is a crying need for such information, and inside of a year after the work is started a considerable amount of usable data should be forthcoming.

August Output 272,640 Cars and Trucks

Carload shipment figures, reported to the directors' meeting of the National Automobile Chamber of Commerce at New York, indicate the best August business on record. A total of 272,640 cars and trucks were manufactured by all the companies in the industry.

This is an increase over July of 12 percent; last year August increased over July 1 percent.

The increase over August last year is 53 percent.

This is by far the heaviest August output on record and is a close second to the production for any one month (289,120) established in June. The previous August record was approximately 190,000 in 1920.

It indicates a total of 1,671,418 for the first eight months of this year compared with 1,668,550 total production of all makers for the entire year 1921. Production by months is as follows:

	1921	1922
January	51,919	90,481
February	65,218	120,293
March	109,758	171,390
April	156,892	219,294
May	163,667	255,167
June	17,757	289,120
First half	725,211	1,145,745
July	176,067	244,355
August	178,831	*272,640

* August, 1922, estimated production report.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Kissel Motor Car Co., Hartford, Wis., has started work on a new power plant construction and equipment project involving an estimated investment of $100,000. A new boiler house, 40 x 80 ft., and 40 ft. high, will be erected first. This will be equipped with three 300-h.p. Sterling boilers with automatic stokers, coal and ash handling and conveying machinery. A 175-ft. brick stack, with an 8-ft. flue, will be erected. The present power house will be enlarged and additional generating equipment installed, as soon as the increased boiler capacity is available. The Kissel company also will build a new battery of dry kilns and lumber curing rooms.

Ford and Lincoln allied interests have the following plant units contemplated or under construction: Factory building to be erected at River Rouge, the general contract having been let to the Everett Winters Co.; alterations to the heat treating building and shipping plant of the Lincoln Motor Co. on West Warren avenue, and a new building 1,600 ft. long for general manufacturing. The Walbridge-Aldinger Co. is the general contractor on both the Lincoln additions.

Gray Motor Co., Mack and Railroad streets, Detroit, manufacturer of automobiles, will commence the erection of a one-story unit, 60 x 600 ft., adjoining a new one-story extension, 60 x 400 ft., just completed. It is planned to build other units in the near future, providing for a daily production of 200 completed cars. F. L. Klingensmith, formerly connected with the Ford Motor Co., heads the organization.

Dodge Brothers, Detroit, have announced that work will begin immediately on the construction of an eight-story addition to their plant, to cost about $1,500,000. The new building will contain approximately 500,000 sq. ft. and will be 400 ft. long. It will be used entirely for manufacturing purposes and will enable the company to increase its production from 650 to 900 or 1,000 cars per day.

Durant Motor Car Co. will erect the following buildings at Flint, Mich., for the production of the Flint Six: Main building, 80 x 900 ft., three stories; plant No. 4, 400 x 80 ft., three stories; plant No. 5, 257 x 400 ft., one story; plant No. 6, 100 x 500 ft., one story. A powerhouse to be erected will be known as plant No. 7. The Christman Construction Co., Lansing, Mich., has been awarded the contract.

T. W. Warner, vice president Durant Motors, Inc., 1819 Broadway, New York, has acquired at a public sale the plant of the New Process Gear Corporation, Syracuse, N. Y., a subsidiary of the Willys Corp., for $1,904,000. The purchase, it is said, has been made for individual account. The plant will be continued in operation and tentative plans are under consideration for enlargements.

Durant Motors of Canada, Ltd., Toronto, have contracted for the construction of new buildings at Leaside, Ont., to cost approximately $1,000,000. The new plant will have floor space of 500,000 sq. ft., and will be used exclusively for the manufacture of Star cars. Production for 1923 calls for 18,000 cars, of which 10,000 will be for the domestic trade and 8,000 for export.

The Hayes Wheel Co., Jackson, Mich., will commence the immediate erection of a one-story addition, 100 x 160 ft., and one-story power house, 50 x 60 ft., estimated to cost in excess of $200,000, with equipment. The company has closed contracts with the Durant Motors, Inc., New York, for wheels for the Durant, Star and other automobiles under this management.

Shafer Bearing Corp., 4500 Ravenswood avenue, Chicago, manufacturer of automobile accessories, has purchased the plant of the All-American Truck Co., 6501 Grand avenue, to provide for expansion. The property covers 8½ acres and includes a one-story building containing 66,000 sq. ft.

Parker Axles, Inc., Gotham National Bank building, 59th street and Broadway, New York, will commence the immediate erection of the superstructure of its new one and two-story plant, 100 x 160 ft., at Poughkeepsie, N. Y., for the manufacture of automobile axles.

Durant Motor Co. of Indiana, Muncie, is reported to be planning for enlargements in its local plant, devoted exclusively to the manufacture of six-cylinder automobiles, to include the installation of additional equipment. W. R. Willett is president.

Liberty Tractor Corp., 535 Griswold street, Detroit, is completing plans for the first unit of its new plant in the Lincoln Park section, one-story, 60 x 160 ft., and will commence construction early in the fall. Other units will be erected later.

Maxwell Motor Corp., Oakland street, Detroit, is concluding negotiations for the acquisition of the entire property of the Chalmers Motor Co., Detroit, including the East Jefferson street plant, equipment, manufacturing rights, etc.

Barley Motor Car Co., Kalamazoo, Mich., manufacturer of the Roamer automobile, is planning for expansion for the production of a new automobile to sell at a medium price. The manufacture of the Roamer car will be continued.

Ford Motor Co., Highland Park, Minn., is reported to be negotiating for the purchase of the plant of the Taubel-Scott, Kitzmiller Co., Chestnut and Elm streets, Trenton, N. J. It will be used as an automobile assembling plant.

Saxon Motor Car Corp., Beaufait street, Detroit, has arranged for a stock issue of $1,000,000, to net about $750,000, a portion of the proceeds to be used for extensions and improvements, and general expansion.

Packard Motor Car Co. is now building marine motors. With this added activity the company is engaged at present in producing power plants for land, water and air travel.

Studebaker Corp., Piquette avenue, Detroit, has awarded contract to H. G. Christman, Stevens building, for a five-story addition, 60 x 443 ft., to be known as plant No. 3.

Ruggles Truck Co., Bad Axe, Mich., has let contract for a factory, 80 x 160 ft., to build truck bodies. The building with equipment will cost $30,000.

Interstate Car Co., Massachusetts avenue and Sherman street, Indianapolis, manufacturer of automobiles, has filed plans for a one-story addition.

The White Co., Cleveland, Sept. 1 moved its executive offices from 6611 Euclid avenue to the plant on E. 79th street.

Paige Motor Co., McKinstry street, Detroit, has filed plans for a one-story steel addition, to cost $30,000.

Body Builders

Seaman Body Corp. of Milwaukee, in which Charles W. Nash holds an important interest, has let all contracts for the erection of extensions which will increase the capacity about 100 percent by Nov. 15 or Dec. 1. The present plant

(Continued on Page 32)

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

E. A. Nelson has been appointed chief engineer in charge of the work of all engineering branches of the Maxwell Motor Corp. **Clyde Sauzedde** has been appointed assistant chief engineer in charge of the designing department having supervision over chassis, body and equipment designing, while **H. E. Maynard** has been appointed assistant chief engineer in charge of all the technical sections of the department. **John Squires** has been made assistant to the chief engineer in charge of the administrative work in the department.

Thomas H. Wickenden and **Charles McKnight, jr.,** have recently joined the development and research department fo the International Nickel Co., New York City, to undertake development work in connection with alloy steels. Wickenden was for many years associated with the Studebaker Corp. as engineer and more recently with the Zeder-Skelton-Breer Engineering Co., in a consulting capacity. McKnight was formerly works manager of the Carbon Steel Co.

Clark Osterheld, assistant general superintendent of the Stoughton (Wis.) Wagon Co., in charge of the motor truck department, has resigned to become president of the Stoughton Mfg. Corp., recently organized to manufacture electric water heaters and other electric devices designed and patented by him. Osterheld took an important part in the work of designing and placing in production the Stoughton freight car when the wagon concern engaged in the manufacture of trucks several years ago.

C. L. Graham of the King Motor Car Co. has been appointed factory superintendent. Graham has been connected with the automotive industry for many years, serving in a similar position with the General Motors Corp. in Flint for four years and later going to Alma, Mich., as production manager of the Republic Truck Co.

A. R. Gould, a director and general manager of the St. Louis (Mo.) Malleable Casting Co., has resigned to join the Malleable Iron Range Co., Beaver Dam, Wis., as vice-president in charge of production. It is understood that the Beaver Dam concern is planning to invade the automotive and power farming equipment field.

James A. Davis, for the past three years manager of the Advertisers & Investors Protective Bureau and investigator for the Illinois secretary of state in the administration of security laws, has been appointed to a confidential position close to W. C. Durant. The exact nature of Davis' new duties has not been disclosed.

Frederic Rueckert has been appointed sales manager and Keith A. Wood head of the material handling division of the Cowan Truck Co., manufacturer of industrial trucks and tractors, organized to promote efficiency in the handling of manufactured products. This service will be at the disposal of customers.

Richard L. Owen, formerly identified with the Brown & Sharp Mfg. Co. as engineer, with Remington Arms & Ammunition Co. as tool engineer, and associated with the Cadillac Motor Car Co., is now interested with Arthur H. Lacey, consulting engineer, Oakland, Cal., in charge of tool engineering.

A. M. Lindsley, engineer with the Alvord Reamer & Tool Co., Millersburg, Pa., has been placed in charge of the advertising department of that company. He will continue his work as engineer. Lindsley was formerly identified with the Cincinnati Milling Machine Co. of Cincinnati.

Harry Huntoon, two years in the engineering department of Deere & Co., Moline, Ill., has been appointed plant engineer at the International Harvester Co.'s tractor plant in Chicago. He will be associated with R. R. Keith, former works manager for the Universal tractor.

D. K. Parker, former assistant purchasing agent of the Grant Motor Car Corp., has been promoted to the position of purchasing agent, left vacant by the resignation of G. C. Starkweather, who has joined the Buffalo Pressed teel Co., as assistant to the president, R. J. McKenzie.

R. R. Jones, chief engineer of the Firestone Tire & Rubber Co., has been named chairman of the Akron section of the American Society of Mechanical Engineers. **J. C. Sproule** will serve as vice chairman and **W. R. Gilliam** as secretary.

Howard E. Coffin, vice president of the Hudson Motor Car Co., has accepted chairmanship of the industrial section in the reorganization and expansion of the Detroit Board of Commerce. Coffin is also a director of the board.

F. D. Schulte has resigned as body engineer and designer of the Stephens Motor Car Co., Freeport, Ill. He will take a three or four months' vacation trip to Europe. His plans after he returns home have not been announced.

Harold G. Pederson, for two years factory superintendent of the Kelsey Wheel Co., Windsor plant, has resigned to join the factory staff of the Franklin Automobile Co., as assistant to the master mechanic.

W. R. Powe will hereafter give his full time to the general traffic management of the Automotive Equipment Association. He has discontinued his connection with all other organizations to do so, it is stated.

Morris Whitfield, for several years in the employ of the Oakland Motor Car Co. as an accountant at the Oakland plant, has been elected assistant treasurer of the company, under Thomas Mayer, comptroller.

George Fritz, formerly manager of the Research Club, an organization of automotive jobbers, has been appointed business manager of the Association of Automotive Equipment Manufacturers.

Robert C. Yates, for many years identified with the Union Drop Forge Co. of Chicago, has resigned to become general manager of the Interstate Drop Forge Co. of Milwaukee.

B. F. Hackethal has been appointed chief engineer for the Fox Motor Car Co. of Philadelphia. He was previously acting in the capacity of consulting engineer for the company.

John A. White, who is well known as one of the pioneers in the battery industry in this country, has been appointed a vice president of the U. S. Light & Heat Corp.

B. F. Wright has resigned as chief engineer of the Republic Motor Truck Co., Inc. He was formerly with the Federal Motor Truck Co. in a similar capacity.

George W. Mason has been advanced to the position of works manager by the Maxwell Motor Corp.

Ralph C. Chestnutt has been appointed chief engineer of the Templar Motors Co. at Cleveland.

Gray Joins N. A. C. C.

Gray Motor Corporation, Detroit, Mich., has been elected to membership in the National Automobile Chamber of Commerce and will exhibit its various styles of Gray cars at the New York and Chicago automobile shows.

Body Builders

(Continued from Page 30)

was erected a little over two years ago, when the old W. S. Seaman Co. of Milwaukee formed a community of interest with the Nash interests, the outgrowth of which was the Seaman Body Corp. The extension will consist of an ell-shaped four-story building, 100 x 423 and 325 x 100 ft., of concrete and brick and will cost about $400,000 fully equipped.

H. & M. Body Corp. of Racine, Wis., owned jointly by the Mitchell and Hupp motor car companies, has started work on the construction of a new battery of dry kilns costing about $130,000 to provide a more adequate supply of lumber and other wood stock for the body shops. The plant is overcrowded with orders for open as well as closed bodies, the volume of which is such that maximum operations until Dec. 31 are assured.

J. W. Murray Mfg. Co., 1975 Clay street, Detroit, manufacturer of automobile bodies and fenders, has leased a portion of the plant of the Durant Motors, Inc., Elizabeth, N. J., for a branch plant. The works will be devoted to the manufacture of bodies and fenders for the Star automobile and other Durant cars. Equipment will be installed to provide for the employment of about 500 men.

Arrow Body & Wagon Works, New York, has been incorporated with a capital of $15,000 to manufacture automobile bodies. It is still in the process of organization and undecided as to the date of beginning operations. The incorporators are: H. Brown, H. Melnic and L. Rubin. The company is represented by R. H. Schenk Aeolian building, W. 42d street, New York.

American Coach & Body Co., Cleveland, has purchased two plants of the James Holam Mfg. Co. of that city, one at Clark avenue and W. 38th street, for the manufacture of automobile bodies, and the other at Clark avenue and W. 43d street, to be used for a metal-working shop. The Holam company has retained a third plant on Brook Park road.

Dodge Brothers' new factory building will be devoted largely to steel closed-body construction. It will be an eight-story structure, cost about $1,500,000, and provide 440,000 additional feet of floor space. Many large presses and electrically-heated enameling ovens will be installed, and warehousing space provided.

Mid-City Auto Body & Wagon Works, Inc., 401 N. Morgan street, Chicago, capital $25,000, has been incorporated by Leo L. Gardner, J. W. Singleton, Marshall Reagen, to make, repair and manufacture automobile bodies, trucks and wagons. Correspondent, Maxamilian St. George, 108 S. Lasalle street.

Parker Mfg. Co., Suffolk, Va., manufacturer of carriages, wagons and parts, has tentative plans for rebuilding the portion of its plant recently destroyed by fire with loss of about $50,000. The new structure will cost approximately a like amount, including equipment. C. E. Parker is head.

Rolls-Royce of America, Inc., Springfield, Mass., now has its new plant for the manufacture of bodies in full operation. As a result, the company finds its production of cars facilitated, and it is said that the output for September will be in excess of August figures.

Martin-Parry Corp. reports sales of bodies about 75 percent ahead of last year, with August sales about double last year. Although dollar volume is smaller than last year per body, total sales in dollars still is well ahead of 1921 because of increased production.

Pullman Co., Chicago, builder of Pullman sleeping cars and other railroad equipment, reports rapid increases in its production of automobile bodies. This company for a number of years has been building bodies on a limited scale for higher priced automobiles.

H. Kaiser & Co., Inc., 23rd and Race streets, Philadelphia, manufacturer of automobile bodies, has acquired a group of factory buildings at Schuylkill avenue and Catherine street, on a site 200 x 260 ft. The property will be used for a new plant.

Inland Body Co., Indianapolis, is perfecting plans for the removal of its plant to Columbus, Ind., where it will occupy a portion of the building of the Emerson-Brantingham Co. Charles S. Murphy is in charge.

Atlas Body Works, Inc., McKinley avenue, Bridgeport, Conn., will build a one-story addition, 45 x 90 ft. The present factory will be remodeled and improved, and a new power house, 15 x 30 ft., constructed.

Ruggles Truck Co., Bad Axe, Mich., will commence the immediate erection of a new plant, 80 x 160 ft., for the production of truck bodies, estimated to cost $35,000. Julius Kirby is president.

Fennessey & Kobler Co., 26th and Parrish streets, Philadelphia, manufacturer of automobile bodies, is planning for the installation of new metal-working machinery and other equipment.

Victor Auto Body Co. has leased for three years the property at 1638-40 South Wabash avenue, Chicago, and will manufacture a special sport model for automobiles.

Lester Carriage & Wagon Co., 115-19 South 14th street, St Louis, is planning to rebuild the portion of its works recently destroyed by fire with loss of about $35,000.

Cambridge Automobile & Wagon Co., 141-49 First street, Cambridge, Mass., sustained a fire loss Aug. 19 estimated at $50,000. It will be rebuilt.

Cynthiana (Ky.) Carriage Co. has plans under way for a branch factory at Covington. J. W. Leek heads the company.

Fisher Ohio Body Co., Flint, Mich., will erect a two-story reinforced concrete factory, 200 x 400 ft.

July Gasoline Production Record Breaker

All previous records for monthly production of gasoline in the United States were broken in July, when 569,711,415 gallons were produced, according to figures compiled by the United States Bureau of Mines. The July output of gasoline represents an increase of 44,000,000 gallons over the June production and 56,000,000 gallons above the figures for May. The increase over July of last year is 150,000,000 gallons.

Domestic consumption of gasoline for July was also the largest ever recorded in a single month, amounting to 566,000,000 gallons as compared with 507,000,000 gallons for June and 457,000,000 gallons for July of last year. The fact that consumption figures showed a larger increase than the production figures accounts for a reduction of stocks of gasoline for the month, amounting to 52,000,000 gallons. Thus stocks on hand Aug. 1 were 772,908,949 gallons, or 6.31 percent less than the figures for July 1, which aggregated 824,966,456 gallons.

Body Hold-Down Clamps

A discussion on the standardization of body hold-down clamps at the motor truck division meeting in July brought out the opinion that this subject is of more interest to body builders than to truck producers, inasmuch as the former usually make their own clamps. The following recommendation was, however, approved for adoption as S.A.E. recommended practice for the guidance of the smaller body builders:

The top or bottom flange of motor truck frames should not be drilled for body or hoist platform holddown clamps. "U" clamps should be used with a woodblock filler between the frame flanges to prevent bending.

The use of too many hold-down clamps for securing the body to the frame should be guarded against, particularly in the mounting of very stiff bodies such as those for oil tanks.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

3092—A commercial agent in Spain desires to purchase and secure an agency for automobiles, tractors, trucks, and automobile accessories. Correspondence, Spanish. References.

3098—A mercantile firm in Czechoslovakia desires to purchase tires, solid tires, automobiles, and motor cycles, and spare parts for same. Quotations, c. i. f. German, French, or Holland parts. Reference.

3138—A commercial agency firm in England desires to secure the representation of dealers in hardware, provisions, motor and cycle accessories, and fancy goods. Payment to be made through bank in London. References.

3140—A mercantile firm in Germany desires to purchase and secure the representation of exporters for the sale of gasoline, gas, oil, and fuel oil, of first qualities. Quotations, c. i. f. Hamburg. References.

3141—The representative of a firm in South Africa is in the United States and desires to secure an agency for the sale of hardware, electrical supplies and equipment, and automobile accessories. Reference.

3145—An agency is desired by a business man in the Canary Islands for the sale of automobiles and accessories. Reference.

3156—An industrial firm in Mexico desires to purchase six 8-wheel log wagons for transporting timbers from forests. Quotations, f. o. b. factory, or c. i. f. El Paso, Tex. Payment, cash. References.

3158—A firm in South Africa wishes to purchase a cold tire setter to shrink any size up to 1 in. by 4 in., side grip, heavy side-grip pattern. Reference.

3197—Commercial agent in Sweden desires to secure the exclusive representation of firms for the sale of motors, automobiles, flying motors, tractors, woodworking machinery, etc. References.

3223—A commercial agent in Italy wishes to secure the representation of firms for the sale of American clincher automobile tires. Quotations, c. i. f. Genoa. References.

3227—Firm in eastern Sweden desires to secure an agency for the sale of lubricating oils in large quantities. Quotations c. i. f. Stockholm. Terms, cash against documents. Reference.

3246—An inquiry has been received from a firm in Sweden for an agency of automobiles, both trucks and passenger cars. A moderately priced car not already on the Swedish market is desired. Quotations, c. i. f. Stockholm. Terms, cash against documents. References.

3253—Commission agents in Spain wish to secure an agency for the sale of automobiles and mineral oils. Quotations, c. i. f. Gijon, Santander, or Bilbao. Correspondence, Spanish. References.

3269—A manufacturing company in Mexico wishes to purchase imitation leather for chair seats. Quotations, f.o.b. factory or c.i.f. El Paso, Tex. Samples and price lists are requested.

3296—An industrial association in Belgium desires to secure an agency for the sale of a four-cylinder automobile that may be sold for about $1,000, or a six-cylinder automobile that may be sold from $1,200 to $1,400. Correspondence, French.

3307—A merchant in Italy desires to secure an agency for the sale of imitation or artificial leather for automobiles and furniture. Correspondence, French or Italian.

3318—A commercial agent in Italy desires to secure an agency for the sale of automobile accessories. Correspondence, French or Italian.

3323—A mercantile firm in Bangalore, India, desires to purchase and secure an agency for bicycles, motorcycles, etc. Quotations, c.i.f. Indian port. Terms, cash against documents.

3401—Fuel oil, paraffin oil, and lubricating oil—Denmark. Agency desired for an American company.

3408—Motorcycles and side cars—Czechoslovakia. The purchase is desired by a buying agent in the United States. Quotations, f.o.b. New York. Payment to be made in New York against documents.

3445—Machine for sewing automobile tires—Mexico. Quotations, f.o.b. place of shipment. Payment, cash. Correspondence, Spanish.

3449—Hardware, textiles, machinery, automobiles, etc.—Argentina. Purchase and agency desired from manufacturers.

3464—Hardware in general, machinery, automobiles, trucks and accessories, office supplies, novelties, and provisions—Cuba. Commission agency and general representation desired. Quotations, c.i.f. Cienfuegos. Correspondence, Spanish.

3507—Automobiles and accessories, motorcycles, and sporting goods—Spain. Purchase and agency desired. Quotations, c.i.f. Corunna or Vigo. Correspondence, Spanish.

3511—American white-oak planks of various lengths, thicknesses, and widths as used for building and repairing railway wagons of all descriptions—Wales, Purchase of goods and agency desired. Quotations, c.i.f. Cardiff, Newport Barry, Port Talbot, and Swansea.

3551—Automobiles—Greece. Agency desired for small car by a manufacturers' agent who has an automobile service station equipped to handle all kinds of repairs.

3560—Lubricating oils for automobiles and industrial machinery—Spain. Agency desired. Quotations, c.i.f. Barcelona. Terms, payment against delivery of shipping documents.

3564—Automobile supplies in general, jacks to lift from 1 to 5 tons, and spanners and wrenches of all kinds—England. Purchase or agency desired. Quotations, c.i.f. London.

3568—Automobiles, tires, and automobile accessories—Spain. Representation desired. Correspondence, Spanish.

3583—Automobiles and bicycles—Spain. Purchase desired. Quotations, c.i.f. Malaga. Terms, payment against documents. Correspondence, Spanish.

3609—Automobiles and trucks, tires and other accessories—Spain. Purchase is desired. Quotations, f.o.b. New York. Correspondence, Spanish.

3617—Motor trucks, agricultural implements, belting, hardware, tools, plumbing supplies, cook stoves, sanitary supplies, and automobile accessories—Palestine. Purchase is desired. Quotations, c.i.f. Jaffa.

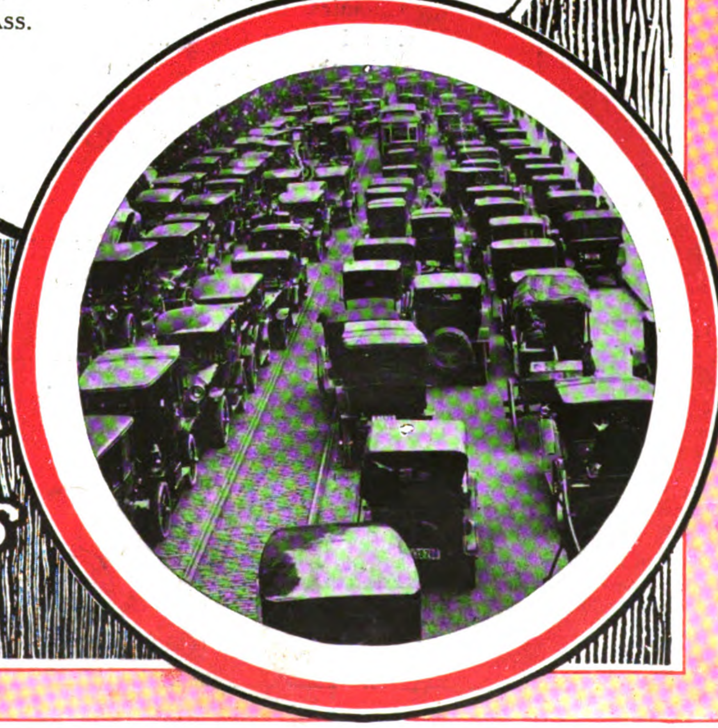
The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1, Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3, Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. LXIV. No. 7 OCTOBER, 1922 $2.00 Per Year Issued Monthly



Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3.

The Automotive Manufacturer

A Consolidation of The Hub and Automotive Enginering

Vol. LXIV. NEW YORK, OCTOBER, 1922 No. 7

Diesel Engines for Motor Vehicles

This Efficient Prime Mover Has Been So Modified That it is Now Available in Sizes and Weights Suitable for Motor Vehicle Uses.

DIESEL engine design has been admitted to be the most efficient method of converting the energy in liquid fuel into motive power but for use in automotive vehicles there have been two great drawbacks, so great in fact as to make this use impossible. The first of these is the tremendous sizes and weights which have been necessary to withstand the pressures of the cycle and also to carry out the necessities of the cycle which has meant an exceedingly bulky and weighty air compressor. The second drawback has been the slowness of combustion. The latter has kept the Diesel engine in such service as was adequately served by slow rotative speeds, as for instance marine work in which speeds below 125 r.p.m. were quite suitable.

In addition, these have been closely bound up with the starting situation for the air compressor has been needed to start the engine because of the great pressure needed. Now a design of a modified Diesel has been developed in Austria with the prime thought of cutting the weight down to the minimum amount possible, and thus, permitting of the use of this efficient unit in automotive vehicles.

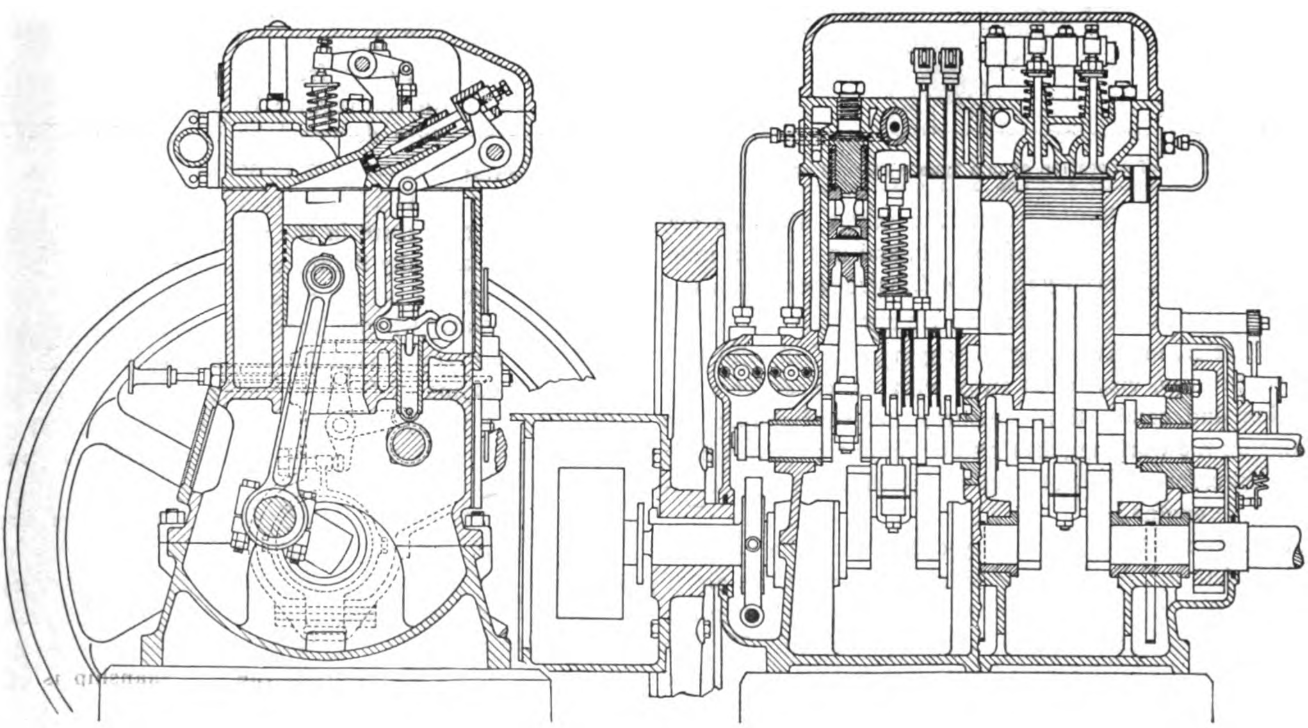


Fig. 1. Sections through the Hindl Diesel-type engine which has been produced in motor vehicle sizes and weights. Note compressor cylinders mounted parallel to main cylinders.

This, shown in Fig. 1 herewith, is of the four-cycle, four-

cylinder type, although the same idea has been worked out with a lesser number of cylinders. It embodies a number of original features and represents the work of Joseph Hindlmeier, a former co-worker of Rudolf Diesel At the present time the engine is being manufactured in three sizes of the stationary type, a 4½ h.p. horizontal, a 7 h.p. vertical and a 14 h. p. twin vertical engine, at Modling, near Vienna; a French company with a capital stock of 2,000,000 francs has been formed at Paris for the exploitation of the Hindlmeier French patent, and we understand that arrangements are being made for the manufacture of the engine in this country.

It is claimed that from an engineering standpoint there is no reason why the Diesel engine canot be built in any commercial size, however small, but in practice there is a limit in output below which the engine cannot be made practical. This is due to the fact that the Diesel is relatively expensive to manufacture. In large engines the extra cost of construction is warranted by the possible savings on fuel cost, but not so in small sizes. Another difficulty with the ordinary Diesel engine is that a good many breakages of parts are experienced, which are due to the high compression and working pressures. Lubricant from the compressor cylinders sometimes mixes with the air, passes over into the air storage tank, and in time accumulates in sufficient quantity to cause disastrous explosions.

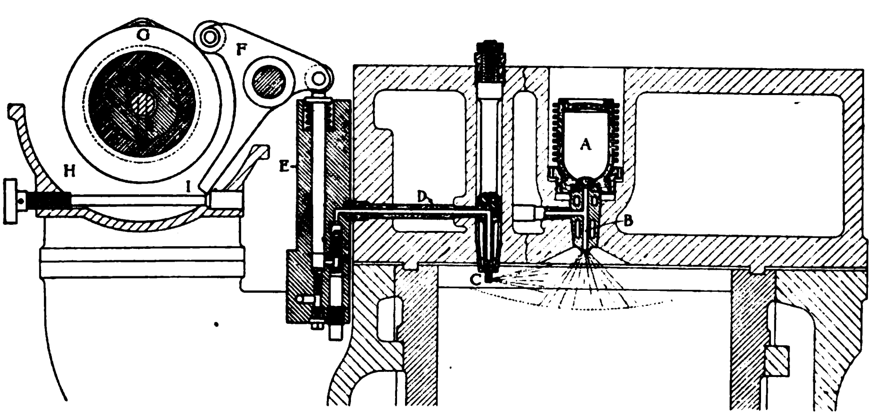


Fig. 2. Diagram of operation of one type of Diesel engine. This is the Steinbeker fuel injection method and has been used in one motor vehicle sized engine.

Eliminating Excessive Compression

Hindlmeier, in developing his engine, worked with two objects in view, viz., to do away with the excessive compression and combustion pressures and thus reduce the strains on the working parts, and to eliminate the auxiliary air compressor and air storage tanks, which tend to complicate the engine.

To do away with the auxiliary compressor, the inventor conceived the plan of compressing a portion of the air of a charge only, rather than the whole amount, to a pressure sufficiently high to insure spontaneous ignition. The air thus compressed is not stored but immediately used in the cylinder, and the need for an air storage tank is thus done away with. This is accomplished by providing a small single-cylinder air pump or compressor integral with the engine camshaft, the compressor being so timed as to deliver a charge of highly compressed air into the main cylinder at the moment the fuel is injected. The fuel is both atomized and ignited by the air charge, and its combustion is completed as it mixes with the air in the main cylinder.

It is readily seen that this system somewhat eases the starting problem. Only a small part of the whole charge needs to be compressed to the high pressure necessary for insuring ignition, instead of the whole charge in the main cylinder, and by using a compression release on the main cylinder the Hindl engine can be started by means of a hand crank. Although the small compressor cylinder must deliver a very high compression, the flywheel weight is sufficient to carry it over dead center when the crank is being turned by hand.

The drawings reproduced herewith clearly show this construction. In the horizontal design the small compressor cylinder is located transversely across the head of the main cylinder, while in the twin and four-cylinder vertical engines the compressor cylinder is located parallel with the main cylinder. Each main cylinder must have a separate compressor cylinder.

Fuel is supplied under pressure by a plunger type fuel pump, from which it is conveyed by small tubing to the fuel admission valve in the cylinder head. This valve is operated from the camshaft in the same manner as the inlet and exhaust valves, but, unlike these, it is of the needle valve type. The engine is governed by a centrifugal governor controlling the amount of fuel allowed to pass on to the injector valve just mentioned. The engine, therefore, is not governed on the hit-and-miss principle, but is a throttling type.

The compression pressure in the main cylinder is carried at about 400 lb. per sq. in., or at from 20 to 30 percent less than in the regular Diesel engine. The pressure delivered by the small single-cylinder air compressor is 700 lb. per sq. in.

It is claimed that on account of the lower working pressure in the main cylinder it is permissible to use materially lighter working parts, and this permits of the use of higher speeds. This, therefore, eliminates the obstacle which hitherto has prevented the use of engines of the Diesel type for automotive purposes. The first Hindl engine of the automotive type is a four-cylinder machine which, we are informed, operates at 1,150 r.p.m. This is within the usual range of truck and tractor engine speeds and shows its field of application.

It is obvious from the above description and an inspection of the drawings that high grade workmanship is required on the engine, especially on the compressor cylinder and piston and on the rings of the latter. The pressure required to cause ignition is produced in a single stage, which can be effected only if the workmanship is of the highest grade. Aside from the machining proper, care must be taken that there will be no distortion of the cylinders after completion, and to this end the cylinder castings must be properly annealed.

We have been informed that the parent works in Austria turn out about 300 engines of this type per month and that companies have been licensed to manufacture the en-

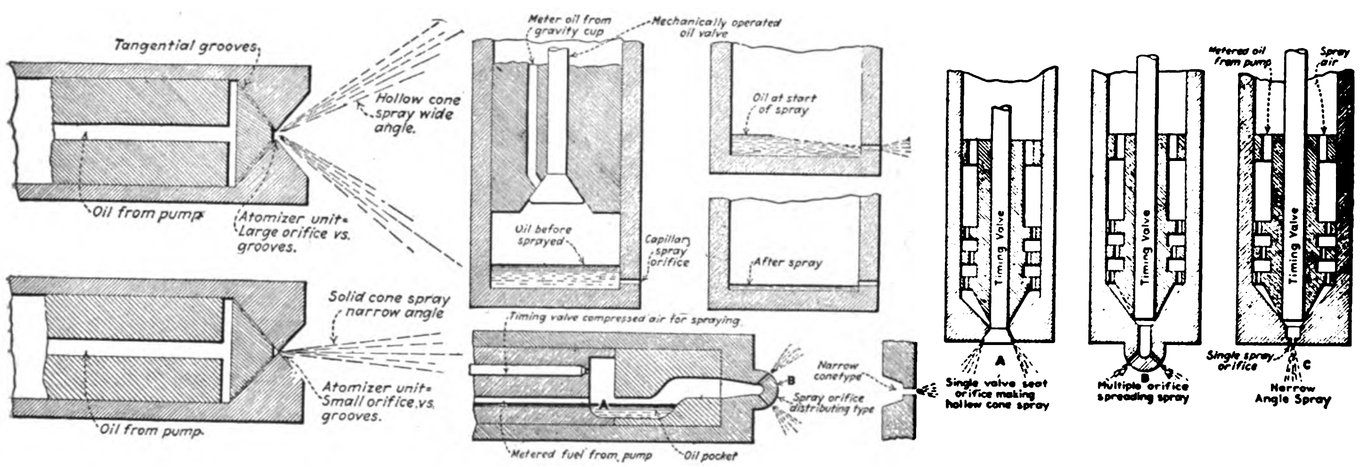
gine in Bucharest, Cracow and Brunn. It is obvious that the most likely field of application of this engine in the automotive line is to tractors, railway motor cars, road tractors, road making machinery and motor boats.

A Two-Cycle Diesel

Another somewhat different solution of the same problem is that shown in section in Fig. 2. This differs from the Hindl machine in that it is of the two-cycle type and in addition has two pistons per cylinder. This is a German design, and is being built by the Deutsche Automobil Construction Gesellschaft. The engine has no air compressor and employs the Steinbeker method of fuel injection. The first engine, now undergoing tests, is said to have a cylinder bore of 130 mm. and a stroke of 160 mm. per piston, making the combined stroke of the two pistons 320 mm. This is equal to a single cylinder engine of 5.12 in. bore and 12.6 in. stroke. The output is said to be 35 h.p. at 850 r.p.m., which corresponds to a brake mean effective pressure of 63 lb. per sq. in. The overall length is only 37⅜ in. and the weight per horsepower 22 lb., which is about the same as that of the average truck engine.

ter position is reached the charge in the firing chamber is ignited by contact with the hot walls thereof, and the pressure in the ignition chamber then reaches 1,100 to 1,400 lb. per sq. in. As a result a column of flame is projected into the combustion chamber. This carries along the fuel now entering the firing passage, spraying it into the combustion chamber. When the piston has traveled a short distance from the beginning of the power stroke the fuel supply is cut off and thereafter the charge expands until the end of the stroke. During the next outward stroke the piston expels the spent gases through the exhaust valve, which is then open. It will thus be seen that in the Steinbeker engine the pressure created by the partial explosion in the ignition chamber takes the place of the high pressure produced by the air compressor in the ordinary Diesel engine.

The ignition chamber is not jacketed but is provided with cooling flanges. In the illustration, E is the auxiliary fuel pump which delivers fuel to the auxiliary jet C through pipe D. It is a simple plunger pump operated by cam G and lever F. Below the camshaft is a small control shaft



Figs. 3 to 6. Some of the types of fuel injection now in current use in Diesel engines. Fig. 3 (at left) Hollow and solid spray nozzles. Fig. 4 (upper center) Cup design of spray nozzles. Fig. 5 (lower center) Open spray nozzles. Fig. 6 (at right) Closed spray nozzles.

It is obvious that if the ordinary Diesel engine were to be built for automotive purposes the most difficult problem would be the construction of the multi-stage air compressor, which must furnish air pressure up to 1000 lb. per sq. in. This is eliminated in the Steinbeker engine, and a simple injection system substituted therefor. A sectional view of the Steinbeker fuel injection mechanism is shown in the cut. To the cylinder head is secured a small vessel called the ignition chamber, which communicates with the combustion chamber through a central passage called the firing passage. The cylinder is provided with the usual inlet and exhaust valves. One fuel jet delivers into the firing passage and another into the cylinder direct. When applied to a four-stroke engine this injection mechanism operates as follows :

During the first inward stroke of the piston pure air is drawn into the cylinder, and during the following outward stroke it is compressed and some of it enters the ignition chamber, the pressure reaching a value of 450 to 500 lb. per sq. in. During the end of this stroke fuel is injected into the firing passage and carried along by the rush of air into the ignition chamber. When the outer dead cen-

H with stop I. The main pump, which is not shown, is of the same type and driven in the same manner.

Starting by Air Bottle

In regular operation the ignition chamber is at a high temperature. The engine is started cold by means of an air bottle which is filled, while the engine is in regular operation, with high pressure air from the engine cylinder. A period of 30 seconds is said to be sufficient for starting, and during this period sufficient fuel flows through the auxiliary jet C for operating the engine under its own power and heating up the ignition chamber. Then operation on the regular cycle begins. The Steinbeker engine is said to be as easily reversible as the regular Diesel engine, a feature which is of importance in marine work.

Mexico to Tax Automobiles

Automobiles, which had not been taxed heretofoe, are now subject to a 10 percent ad valorem import duty. The tax exemption had been decreed several years ago by Carranza in the belief that it would help the farmers and business in general.

Investigation of Automobile Brake Linings

Bureau of Standards Tests Help Manufacturers to Turn Out Vastly Improved Product—Apparatus Used—Methods—Results

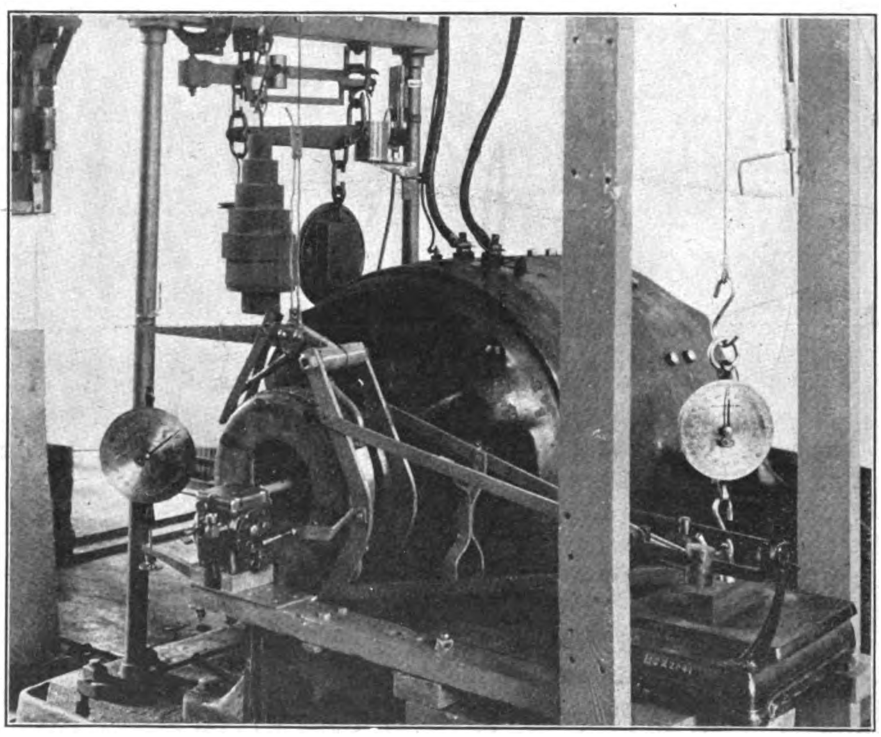
BY HUGH G. BOUTELL*

EVERY owner of a motor car will admit that there is nothing more important on his machine than the brakes. Ability to start quickly is a valuable asset in any car, but to be able to stop quickly is even more important. The truth of this statement has been recognized for years by builders and users of automobiles, traffic officers, and insurance companies, and at first thought it seems rather strange that no standard method has heretofore been used for testing the efficiency of the material on which the success of all automobile brakes depends, i. e., the brake lining.

Recognizing the importance of an investigation of this sort, the Bureau of Standards was requested by the Motor Transport Division, Quartermaster Corps of the army, to carry out the work, in cooperation with the Society of Automotive Engineers and the various manufacturers.

The nature of the investigation, with no previous data to serve as a guide, necessitated a very large amount of preliminary work, so that it is not surprising that although research on brake linings was commenced during September, 1919, the work is not yet entirely completed. Although much remains to be done, certain definite and important results have been secured and made available to the industry.

Before taking up the results of this work, it may be of interest to consider briefly the apparatus employed to carry on the large number of tests which had to be made. The new dynamometer laboratory of the bureau is the building in which all sorts of investigations of internal combustion engines and appliances are conducted, and the necessary equipment for brake lining tests was set up there as soon as the building was completed. This testing equipment is clearly shown in the photograph. An electric dynamometer is used as a motor and on the end of its shaft is mounted a standard automobile brake drum. When desired this drum can be cooled by running water. The sample of brake lining material to be tested is riveted to a brake band made in two sections, which in turn is connected to a horizontal arm.



Set up of apparatus used by Bureau of Standards in testing brake lining

This arm bears on a scale, so that the force tending to cause the brake band to revolve with the drum can be measured. The tension of the two sections of the band can be regulated between any desired limits and is indicated by a spring balance. This arrangement will be recognized as similar to the familiar prony brake used in determining the horsepower of engines, motors, etc. A great number of tests on standard sample linings, simulating ordinary service and severe service conditions, have been carried out on this apparatus.

Meetings have been held with all those interested, and where weaknesses in brake linings have developed, the manufacturer has been told of possible improvements which might give him a more serviceable product.

Although, as previously stated, the work is still incomplete, valuable results on asbestos fabric linings have been secured. It is evident that there is a general agreement in the industry on the necessity for a standard method of testing brake linings, and as to the value of the bureau's work. This is an important initial accomplishment, for without the backing of the industry, research work of this kind could not be carried out.

Already, very wide differences have been shown to exist between various asbestos fabric linings on the market. Shortly after the work was started, the bureau's accelerated test representing "severe service" conditions indicated that the durability of some linings was many times that of others, although all are sold to the ultimate consumer at the same list price for a given size.

Ever since the first conference between the Bureau of Standards and those interested in brake linings, manufacturers of this material have been giving a great deal of thought to the improvement of their product, and in this connection, are availing themselves of the methods and equipment so far developed by the bureau. Nine manufacturers who are using such equipment and methods for testing are understood to produce over 90 percent of the present total output of asbestos brake linings and consti-

* Associate Engineer, Bureau of Standards.

tute more than one-half the number of makers of the finished product.

The more or less haphazard methods of testing which were previously employed, are giving way to systematic investigations of the influence of modifications in materials and manufacturing processes on the finished product. So important do at least two large manufacturers consider the work, that they are operating their test equipment on a 24-hour day schedule.

Recent tests of brake linings, representing the current regular product of the leading manufacturers, show from 100 to 300 percent greater durability than the same manufacturers' standard product of a year ago. This result does not appear to be due to any one particular improvement in the manufacturing process, but to the increased attention which is being paid to production methods in general. A conservative estimate points to at least a 100 percent increase in durability of 90 percent of all the brake lining manufactured, in the very near future, and without any material increase in the cost to the maker. In this connection, it should be remembered that this direct saving in material, resulting from increased durability, brings with it an almost equal saving in labor through less frequent replacement and adjustment. Any one who has had to spend a half day in replacing worn out brake linings can appreciate what this means to the owner of a large number of cars.

Another valuable result of the work has been its influence on government purchases. Several branches of the federal government buy large quantities of brake lining, and they are now basing their orders on the bureau's tests. While their requirements are small compared to those of automobile manufacturers, the saving, through the purchase of material on a scientific basis, will be considerable and would in one year amount to several times the entire expense of the investigation.

Orders, instead of being awarded to the lowest bidder among those manufacturing a material which will pass certain specified minimum requirements, can be placed on the basis of lowest cost for a given service, and recommendations to this effect are being sent to all interested branches of the government service.

To sum up: As a result of this work, very desirable cooperation between the government and a large manufacturing industry has been brought about; definite results of the highest value have been secured, and a large amount of money will be saved the automobile-using public, which in these days represents almost everyone in the country.

The practical importance of this work is apparent when we remember that the average total annual consumption of asbestos brake lining in this country is between 40 and 50 million feet, equal to two and one-half times the circumference of the earth. Assuming an average value of 85c per foot to the consumer, this represents between 32 and 42 million dollars, or about 24 times the entire appropriation for the Bureau of Standards. In the government service alone, the yearly consumption is approximately 250,000 feet.

In addition to the work already under way, an equally large field for investigation exists in the brake and transmission bands used by the Ford car, none of which are included in the above figures, since for these bands cotton without asbestos is almost exclusively employed. The total consumption by Fords is probably in excess of 50 million feet.

In closing, the writer wishes to express his appreciation of the assistance given him in preparing this article by S. L. Van Ammon, under whose supervision the brake lining work is being conducted.

Fred Martin to Leave Sheldon

Fred L. Martin, sales manager of the Sheldon Axle & Spring Co. since 1911, has resigned, effective Dec. 31. After that date he will devote his time to the sale of the Fageol Intercity Safety Coach, made by Fageol Motors Co., Oakland, Cal. He will act as eastern representative of the company with headquarters at Wilkes-Barre, Pa.

Martin started with Sheldon prior to its making the worm gear type axle which is now its standard. Since 1911 the sales of the company have increased from $20,000 a month to several hundred thousand dollars monthly, the increase being made up largely of worm gear axles. Martin's many years' experience in the parts field has brought him in contact with motor truck builders and furnished him with experience of much value in his new field.

Burdick to Make Steel Wire Springs

John S. Burdick, formerly vice president and general manager of the Buffalo Body Corp., has incorporated a company at Hamburg, N. Y., for the purpose of manufacturing steel wire springs for use in automobile coach-work upholstery. The company will be known as the Burdick-Atkinson Corp. Associated with Mr. Burdick, who is president and general manager, are Frederic R. Atkinson, vice president and factory manager; Franklin R. Brown, treasurer, and Harry Burdick, secretary.

Australian Auto Industry Active

The automotive industry in Australia is confined to body building and assembling of cars from imported and locally manufactured parts. The slump in the industry was over by April of this year and body builders were then reporting more orders than they could handle. Body building is encouraged by high tariffs on imported bodies and by a regulation prohibiting the entry of more than one automotive body to every three chassis. Approximately 95 percent of the cars imported arrive without bodies. During the months of May, June and July the imports of passenger cars from the United States and Canada alone totaled over 1,000 per month. It is estimated that the replacement market averages about 2,000 cars per year. The total registration amounts to about 78,500. The principal demand during 1922 and 1923 should be for medium-priced cars, accessories, and all classes of material for body building and fitting.

One Auto for Every Ten in United States

A semi-annual statement issued by the Chamber of Commerce shows that the present automobile registration in United States amounts to 10,863,744 against 9,434,971 at this time last year. The increase amounts to 15 percent for the entire country or 1,428,773. The increase since first of year is 415,744. The tabulations are based upon official figures obtained from secretaries of states and other registration officials in all the states of the union except New Mexico. New York leads with a total 843,631 against 658,438 on July 1, 1921. Ohio is second with 779,500 against 677,000 last year.

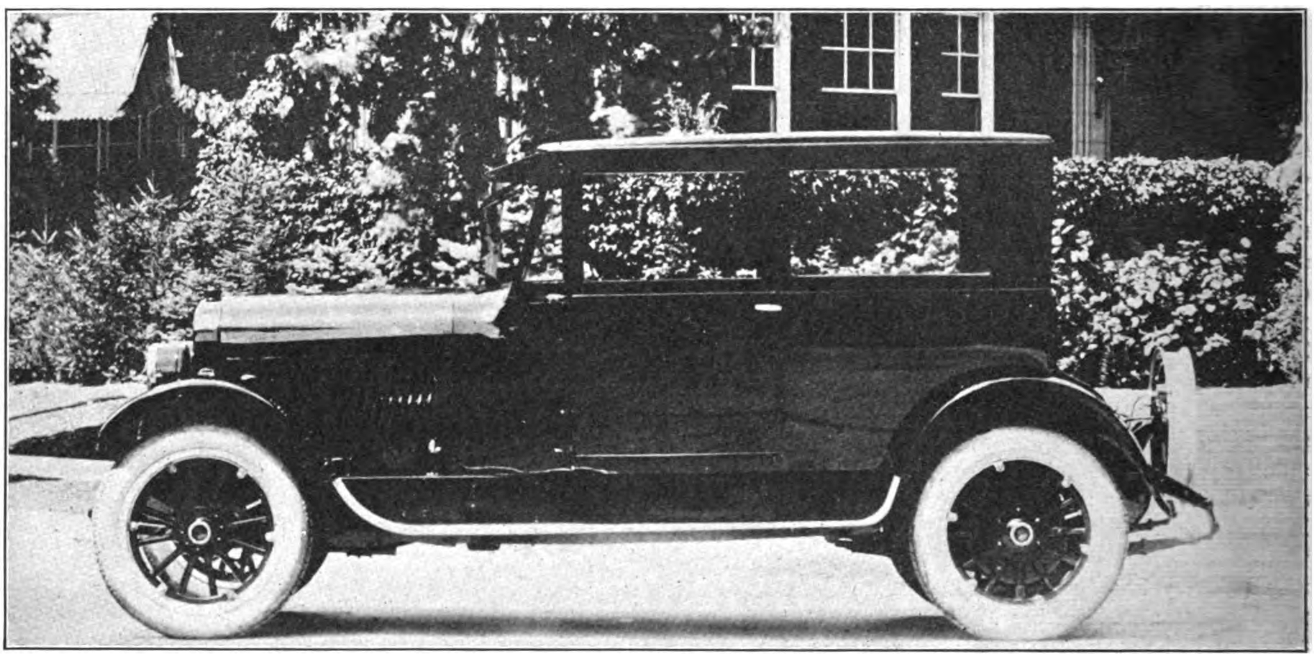
Closed Car Show a Great Success

New York Display, on Much Grander Scale Than Last Year, an Even Greater Success—Several New Models—Bright Colors Absent—Good Business Done

LAST year, when the first of the closed car shows was held in a small hall and on a small scale, there were many, both manufacturers and dealers, who doubted its success, doubted it to the extent that they would not participate. However, it was a great success, and coming at exactly the right phychological time for such a display a very fine lot of business was done so that those participating were more than satisfied.

This year, the display was repeated on a much grander scale, in no less a hall than Grand Central Palace, and it was proportionately just as great a success. In fact, it may be said to have been so much of a success that from now on we can number the Annual Closed Car Show as one of the automotive fixtures.

The exhibition was a dealers' show held under the auspices of the Automobile Merchants' Association with the sanction and support of the National Automobile Chamber of Commerce. The atendance was more than satisfactory to the exhibitors and suggested something of the enthusiastic crowds which pour into the Palace during the big national shows in January.



One of the new models at the show was the Lexington Royal Coach, selling within $450 of the open touring car, bringing the enclosed car within the reach of all.

Little Brilliant Coloring

As one entered the building he was confronted with the exhibits of the Marmon, Hudson, Essex, Studebaker, Packard, Peerless, Cadillac, Jordan, Cole, Buick and Pierce-Arrow cars. The Hudson and Essex cars attracted some extra attention from the fact that price reductions have just been announced on some of the models. All of the Essex models were reduced by $50 and the Hudson coach, of which two fine models were shown, was lowered $125, making its New York delivery price $1,770. One of the striking Hudsons was a special sedan finished in maroon with yellow trimming, and there was also a fine collapsible brougham. The Essex coach had a mirror equipment for the first time on the left mud guard, this being a refinement added by Harry Houpt of the local agency.

A new feature in the Marmon exhibit was a Brewster-made aluminum sedan body mounted on the standard Marmon chassis. All future Brewster cars, it was announced, unless otherwise specified, will be mounted on the Marmon chassis. One of the smart Marmons was a collapsible town car, in a rich gray, with a nicked radiator and searchlight.

Very few brilliant or so-called sport colors were to be seen. The closed cars, in their body coloring, typify richness and conservatism, and dark tones predominate. The Kissel car, for instance, which is usually seen in yellow, brought out its closed models for the coming season in a dark blue or black, a five-passenger coach and a six-passenger sedan being shown. The Earl, in addition to its more subdued bodies, had a special coach finished in light gray with orange trim and a trunk rack with small trunk on the rear. This trunk equipment is very general this season on many models of the closed cars.

New Durant Model

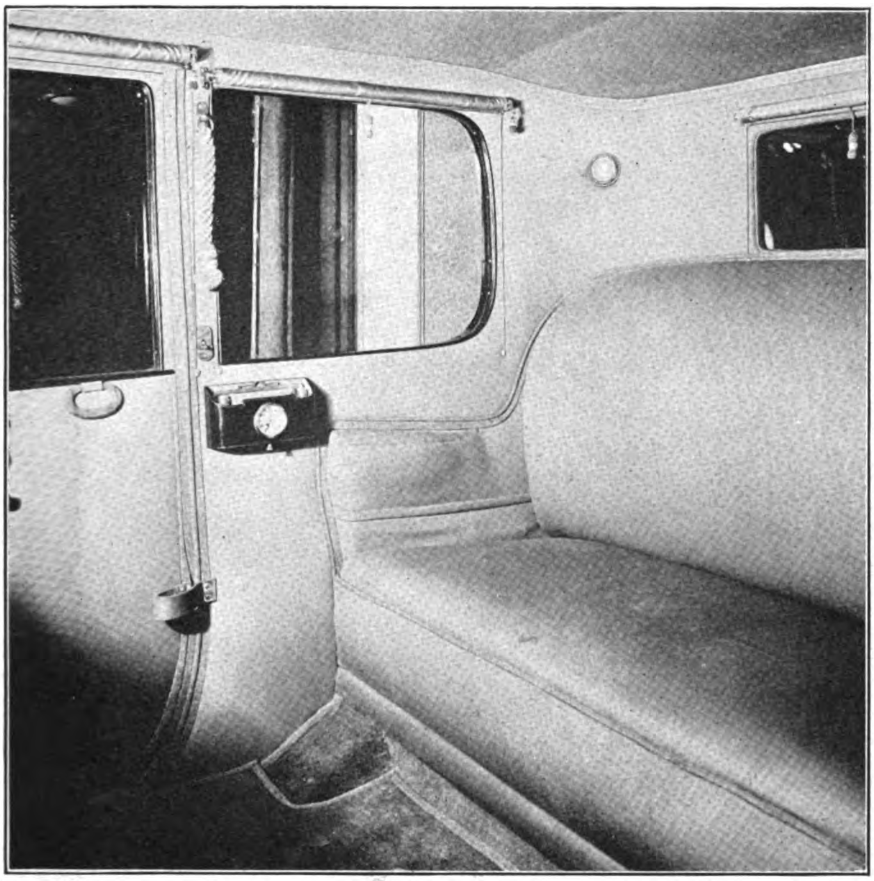
The Rickenbacker showed two special bodies in a rich brown, the Jewett had a smart coupe with blue disk wheels and among the Paige cars there was a rich sedan finished in maroon with red striping. The features in the Packard exhibit were the single six coupe and five-passenger sedan. The Cadillac featured a new Victoria model with wide seats and rear corner reading lamps. Among the Durant sixes and fours was the new Star sedan, the new small car just brought out by W. C. Durant.

In the large Studebaker exhibit were the four passenger coupe and the seven passenger sedan on the big six chassis, shown for the first time. As standard equipment there are nickel plated radiator shell, bumpers front and rear, mo-

tometer, trunk rack and extra disk wheels. The special six and small six models were represented by coupes and sedans with many refinements. The Reo also showed for the first time a new coupe and a new sedan model. The former seats three passengers but a fourth may be carried on an auxiliary seat and the sedan is a roomy five passenger vehicle. The closed drive sedans and a limousine in the Pierce-Arrow booth revealed their customary richness in coach work and distinctive finish.

Subdued Colors Rule

For the first time, perhaps, in an automobile show in New York no brilliant red or pure white cars were dispayed. The red color was in early years generally recognized as the badge distinctive of sporty tendencies and road speed, and it was seen more freely on open cars than in the closed models. The pure white, socalled bridal car. which, with its smilax and white satin ribbon has been a showy feature of more than one motor car exhibition, has also ceased to attract.



Fine upholstering of the plain type without pipes or diamonds were many at the show. This shows Boyriven gray broadcloth used for a limousine interior.

The characteristic feature of the show as exemplified by the 200 or more closed models was the appeal made to practical use and sensibility. Several special body jobs showed the exterior finish in colors differing from the standard dark tones, but in these special cases, in the use of grays, maroon, deep blue, dark green or buff, the aim was invariably directed to suggest refined elegance.

Fancy Names Going

The former tendency toward fancy and usually incomprehensible names for certain body types is, happily, on the wane, and the majority of makers and dealers are content to call their models by the well-known terms—coupes. sedans, broughams and limousines. The overworked suburban sedan is passing out of favor with many other sedan name combinations.

The Moon car exhibit, in its new sedan model for the coming year, showed the regular stock car in its glossy black finish and a special body, on the same chassis, the exterior being entirely in gray with a delicate trimming of different tone. The wheelbase is 115 inches, and the interior has been carefully designed to provide the maximum of room. The car has four doors, snare-drum type lamps, a dome light operating from the switch and all of the other standard conveniences.

The new Big Six Studebaker sedan, a special body type shown for the first time, is one of the few bodies which contain as standard equipment two extra tires and wheels. Disk wheels are used, and another new feature is the ample trunk rack on the rear. This extra equipment for the special Studebaker adds less than $200 to the cost over the regular seven-passenger sedan. The wheelbase is 126 in. Two smaller chassis types are made by Studebaker, one of 119 inches and the other 112 inches, both of which are mounted with sedan bodies for five persons.

Practically every dealer participating reported satisfactory sales, these ranging all the way from one to forty cars. These were, in fact, so numerous that the show manager is reported to have claimed that a million dollars worth of business was done at the show itself, while active prospect lists which should be worth as much more, were secured.

Many New Bodies

Many new models were seen for the first time. Among these were Stephens, Haynes, Velie, Cleveland, Lexington, Durant, Gray, Willys-Knight, and others. Stephens had two new models, five-passenger brougham at $2,000 and four-passenger coupe at $2,450. The former is characterized by 32-inch doors and unusually generous legroom for occupants of the rear seat.

Velie exhibit included a new five-passenger brougham at $2,185. This price includes trunk and trunk rack at rear. At the Cleveland stand were a special coupe at $1,620 and a special sedan at $1,710, the former with front bumper, disc wheels and trunk rack, and the latter with five wire wheels and trunk rack. Lexington's new five-passenger royal coach at $2,145 was also shown.

The show gave New York its first opportunity to see the new Haynes 1923 "55" sport series. This includes the specially-equipped and finished models previously reported. The new Roamer-built Barley was introduced to the trade on this occasion.

Several at Very Low Prices

A new Durant four-cylinder coupe for business and professional men was revealed. This is a two-passenger design identical in every respect with the four-passenger coupe except for the single seat and large compartment behind it. The Gray $760 five-passenger coach was also exhibited.

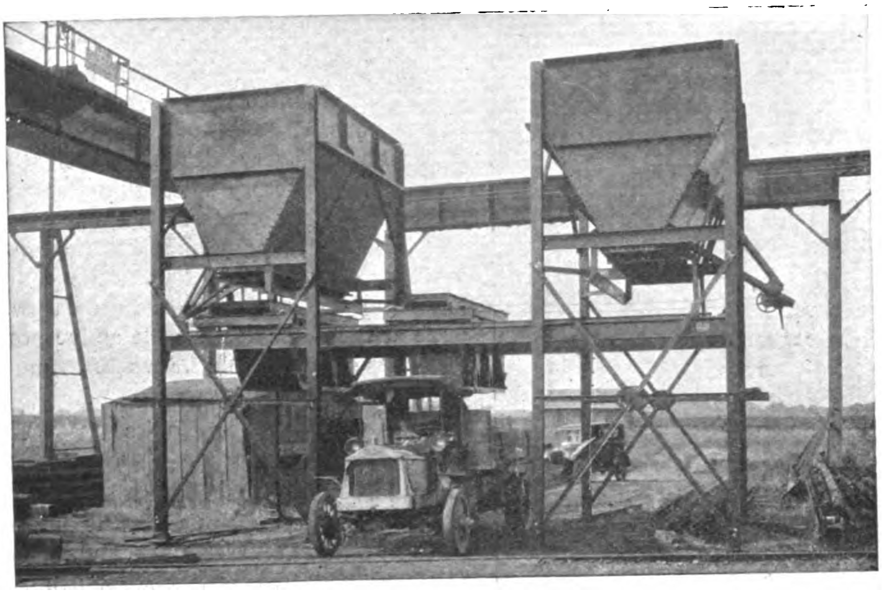
(Continued on Page 27)

Road Construction Contractor's Equipment

Ideas Which Have Been Tried Out, Special Features Which Have Proven Successful, Concrete Boxes. Standardization. Time Schedules. Others.

MUCH road construction work has been done the past year, and much more is in prospect for the coming year. A considerable part of this new road work is of concrete and, as is well known, concrete takes a deal of special equipment, special methods to turn out a high class job cheaply and quickly. This makes important what has been done or is being done in this line by successful contractors in road work today.

Among the details to which considerable attention must be paid is that of careful finishing of the surface. Through experiment and observation, the Washington state highway commission has evolved a standard method of finishing all concrete roads built under its supervision. Highly satisfactory results have been obtained with this method on all road work on which it has been used.



This central proportioning plant was used on Erie county road work and proved so successful that similar plants built of steel are now being manufactured for road contractors.

The contractor is required to equip himself with a set of finishing tools designed by the commission, and these must be used in the manner specified. They consist of a standard subgraded template, strike board, wooden float, straddle float, finishing board, finishing roller, and a straight edge for truing up joints. Besides this, other necessary tools are a hand float, small trowel, edgers, contractor's name and date stamp and a pavement bridge. Two strike boards are required, one for use on tangents and one for super-elevated curves. The strike board used on tangents will be a "crown" template, built according to standard plans. That used on superelevated curves is similar in construction detail to the "crown" template but its cutting edge is a straight line instead of crowned and its length must be equal to the total maximum width of the pavement plus two feet.

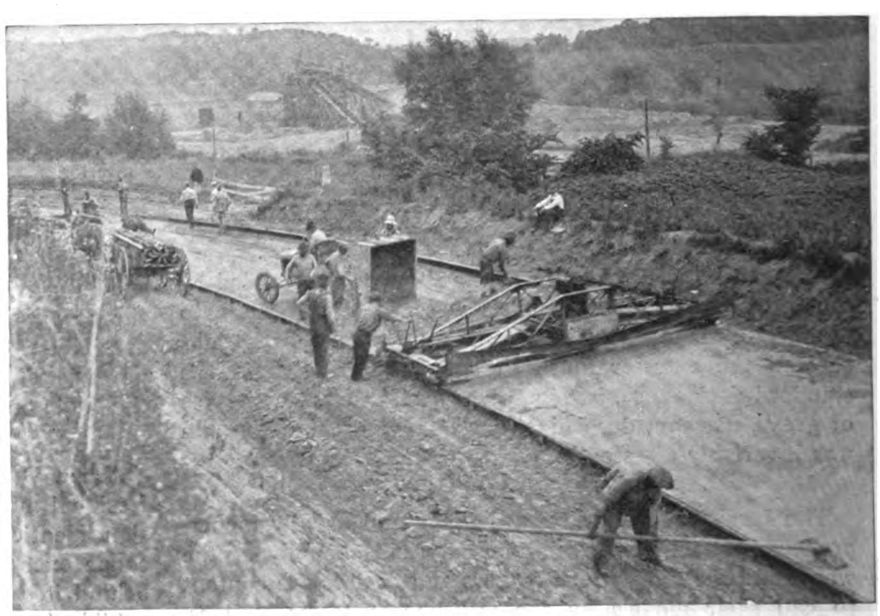
Standard Surface Finishing Methods

The finishing which is carefully watched by inspectors is governed in every case by standard methods. These methods are as follows: Concrete is struck off with the standard "crown" template, which is worked backward and forward in short strokes and up and down to tamp the concrete. Long strokes tending to "tear" the surface of the pavement are not permitted.

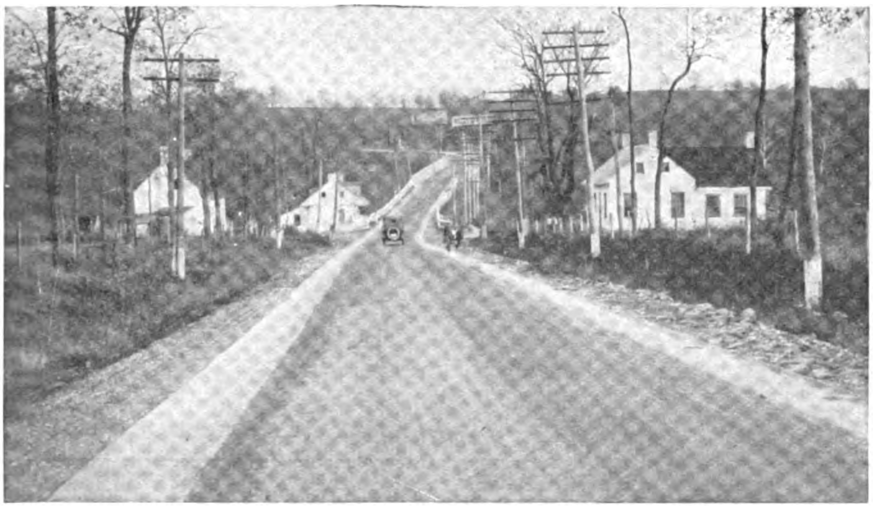
After being struck off, the concrete is rolled with a standard iron finishing roller. This operation removes excess water, embeds the larger pebbles and produces a film of mortar which will finish readily. Immediately following the roller the surface of the pavement is thoroughly floated with the standard, long-handled wooden float.

Following this operation, and before the surface has become hard or "sticky" the final finish is given with a standard finishing board. This board extends entirely across the pavement with a handle at each end. The finisher with the help of a workman moves the board slowly and with a continuous motion across a full panel. The board must be moved back and forth usually from three to five times before a smooth uniform finish is obtained.

To overcome the slight displacement which sometimes occurs at expansion joints because of the use of the finishing board, a straddle float, also of standard design, is used on all joints immediately following the final board



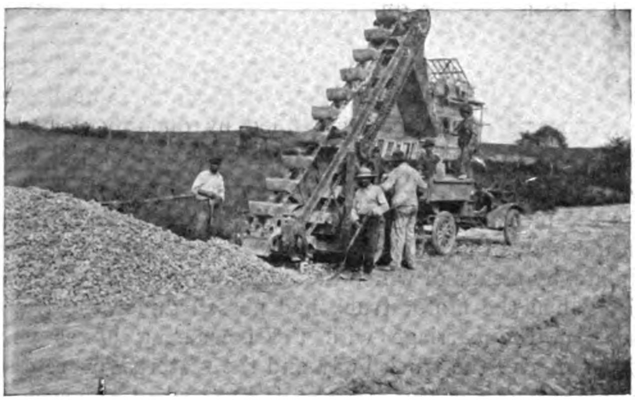
Concrete for the Walla Walla county road was mixed at a central mixing plant and carried to the subgrade by truck with elevating dump bodies.



Type of wide shoulder on concrete which has been found successful for old highways in Maryland. The shoulder is four feet wide.

finish. All float marks are taken out with a hand float, and all exposed edges are rounded with an edger having a ½-inch radius. Joints are finished with a ¼-inch edger.

Proper curing methods are given the careful attention they merit. The ponding method is preferred wherever

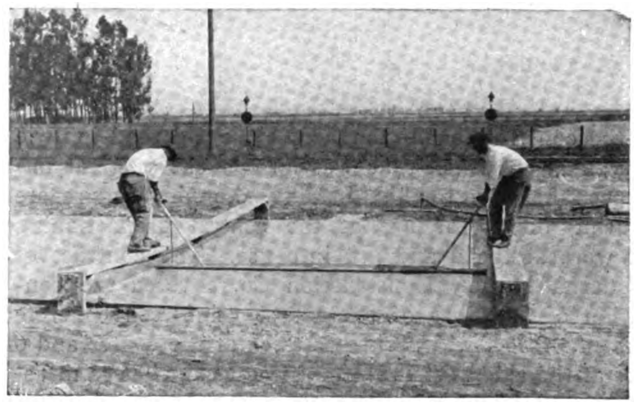


Portable loaders, transferring materials from stock piles along the road to trucks or wheelbarrows have been instrumental in saving time and labor on several contracts.

this is feasible. The road is kept closed to traffic for at least 30 days.

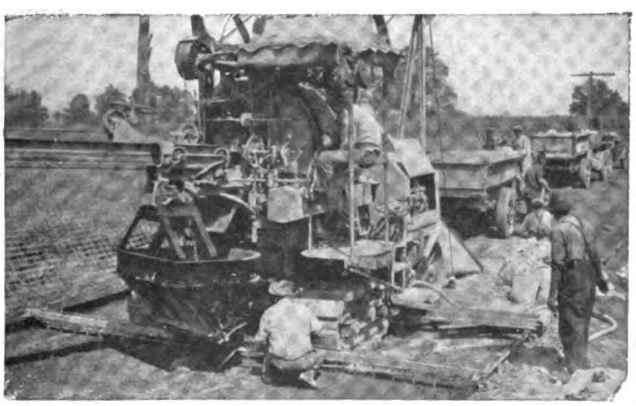
Curves Super-elevated and "Spiralled"

A simple and successful method of making the transition from the full crown to the flat section at the point of maximum super-elevation on curves has been adopted as standard practice on all state highway work. Ribbons or header boards are put into grade, the outside ribbon being raised to provide the correct super-elevation at each point along the curve. Super-elevation begins at a point 50 feet back of the point of curve and reaches a maximum 50 feet ahead of the point of the curve. The transition from "crown" section on tangents to the super-elevated straight section on curves begins at a point 50 feet back of the point of curve and ends 10 feet ahead of the point of curve. Concrete in this section is first struck off with the crown template. Four tapering strips are then set up on the outside ribbon, the highest point being at the point of beginning of super-elevation, the height of the strips gradually lessening until it runs out 60 feet from the beginning of super-elevation. The straight edge template is then used, one end riding on the ribbon on the inside of the curve and the other end riding on the top of the tapering strips. By the use of this template the transition section is gradually changed from a crowned surface to a flat surface with the required super-elevation. Formula is used

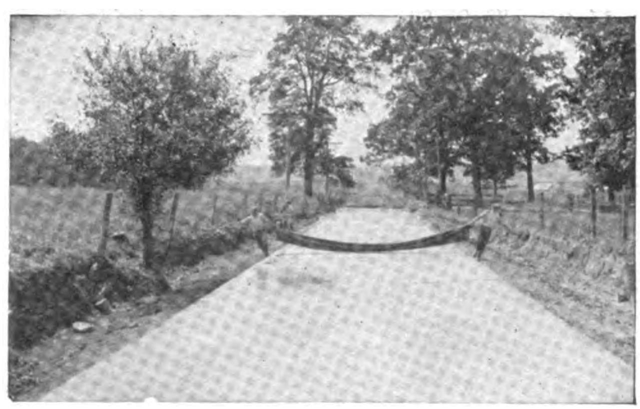


Longitudinal floats have found much favor in the construction of Los Angeles county roads. The float is 15 or 20 feet long with a wide troweling surface. It is operated from bridges as shown, with its length parallel to the center line of the road. It will iron out any longitudinal waves that may have escaped the template or roller.

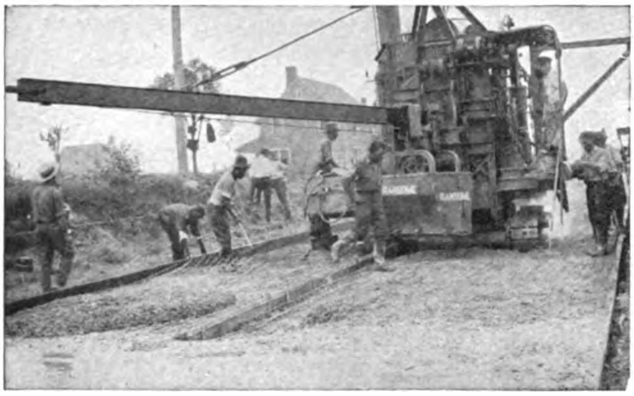
for determining the dimensions of the tapering strips and shows the method of procedure adopted. A smooth riding transition is thus obtained without the necessity of setting a lot of grade stakes and stretching strings or other cumbersome methods often used.



To insure an absolutely true sub-grade, one contractor has equipped his mixer with a "sub-grade machine." This is fastened under the mixer and extends across the road between the front and rear wheels of the paver, evening off the sub-grade irregularities as the mixer advances. A "scratch template" checks the sub-grade before concrete is placed.



The use of strips of burlap for curing concrete immediately after finishing has been found to have advantages. The burlap is so light that it will not mar the freshly placed concrete. It is of such a nature that it absorbs and retains water readily and the strips are easily moved ahead as the work progresses.



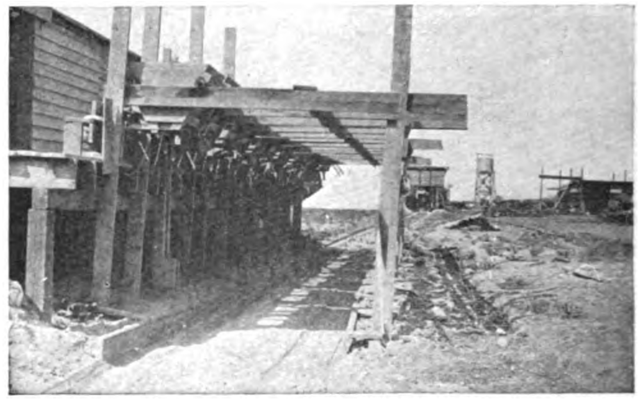
Many New Jersey highways are being built with a center longitudinal joint made of 1/16 in. metal fitted with a metal cap of three ⅛ in. pieces riveted together. After the finishing the cap is removed leaving an opening directly over the plate. The edges are then rounded off with a grooving tool, leaving a ½ by ½ in. groove, which is later filled with bituminous material, effectively sealing the joint and leaving an even, black mark along the center of the road.

The proper finishing of concrete road surfaces is a matter of utmost importance and expert finishers are rare. The equipment and methods designed by the Washington state highway commission are planned so as to get the best possible results with even mediocre men. By the use of this method the personal equation of the paver is eliminated and a strict observance of the specifications under careful inspection insures satisfactory results under all conditions and with many varieties of labor.

Special Batch Boxes Save Money

In the construction of the Erie-Cleveland road in Erie county, Pa., on which time was an element of great importance, flexible rapidly loading dumping aggregate measuring boxes for use at the central proportioning plant were designed and put into use. The contract of the Charles H. Fry Construction Co. covered the construction of 5.6 miles of one-course reinforced concrete pavement, 18 feet wide, 8 inches thick at the center and 6 inches at the sides. A 1:2:3 mix was used. These measuring boxes effected a saving in the time required to load and proportion aggregate batches.

The central proportioning plant was located at a railroad crossing about midway between the two ends of the job, the average haul being 1.4 miles. Five 5-ton trucks were used to haul the material from the bins to the mixer. The truck bodies were divided into four compartments each of sufficient size to contain the sand and stone for a five-bag batch. Cement was added to the batch at the mixer and was hauled to the mixer on trailers, each containing 20 bags of cement. The trucks experienced no



The cement content for a batch of concrete was placed in the hoppers shown in the above illustration. When trucks loaded with sand and stone stopped to receive the cement content, the boxes were pushed out on the runways, the contents dumped and the box refilled for the next load.

difficulty in hauling the trailers in addition to the five-ton load of sand and stone.

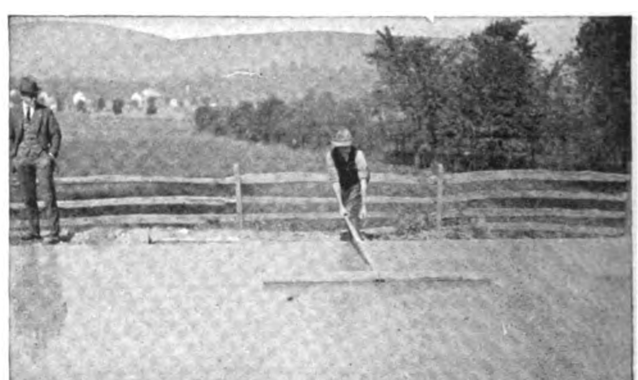
The central proportioning plant consisted of an overhead bin with compartments for sand and stone. Two batteries of measuring boxes, four boxes in each battery, were placed under the bins. These were supported on carriages which traveled on tracks extending from under the bin to a support on the outer side of the driveway. There were two extension tracks, one from the stone bin, the other from the sand bin. The stone and sand carriages operated independently of each other. The boxes of the measuring device were filled by opening vales in the bottom of the bin. A slight excess of material was allowed.

As the measuring boxes rolled along the track to their position above the truck body, they passed under a strike-off plate, by means of which the boxes were struck off level full. When the motor truck had passed under the track extension, the carriage with the measuring boxes was rolled out over the truck body and the materials were discharged into the compartments of the truck.

The doors of the boxes in one carriage were all controlled by a spur gear so the operator could easily regulate the speed of discharge and drop the material gradually into the truck. This eliminated destructive impact often ruinous to trucks. The effect of the blow was further lessened by the fact that the truck cabs did not have to clear the bottom of the boxes since these were rolled into place after the truck was in position, thus eliminating an additional drop of three or four feet.

After the stone was loaded, the truck pulled ahead until

By bending the points of ordinary spades as shown in this picture, one contractor found that the work of spreading concrete on the sub-grade was facilitated.



A 10-foot straight edge, placed at the end of a long wooden handle makes it possible to check the surface of the concrete before the initial set has taken place. If irregularities are found, they are easily remedied while the concrete is still workable.

it was beside the sand bin. The carriage carrying the sand boxes was then pulled out over the truck and the measured amounts of sand were dropped into each compartment on top of the stone.

The measuring device worked out entirely satisfactory. Only one man was required to proportion and load the materials and the average time of loading a truck with its 5 tons of material was 55 seconds.

The bins are patented by the Chas. H. Fry Construction Co., and formed the basis for the development of an all-steel portable aggregate bin built and equipped very much like the wooden bins used on the Erie-Cleveland road job. The steel bins are so designed that they may be dismantled and shipped to a new location there to be reerected. They are manufactured and placed on the market by the Erie Steel Construction Co., Erie, Pa. Several of the all-steel plants have been used on highway construction projects and all of them proved successful.

Better Business Methods Save Money

In the building of the Mt. Vernon road in Lima county, Iowa, the Henry W. Horst Co., contractors, proved that better business methods, the use of carefully laid-out time schedules, standardization, and other modern ideas are equally applicable to contracting work, and when so applied will save the contractor time and money.

With this company, when a job has been awarded, company representatives visit the job, study conditions and decide on methods and equipment to be used. A paper layout is made and the work divided into sections, each section being scheduled for completion on a certain, set date. Schedules are based on the capacity of the equipment to be used, with allowances made for adverse weather conditions and other anticipated delays.

The plant is planned at the home office in Rock Island, Ill., and conforms as nearly as possible to standard plans previously established by the company. These include bunk houses, cement storage sheds, repair shops, and other structures. Even the central mixing plant conforms to a standard plan with minor modifications to suit local conditions.

Before going on the job, the organization selected to build a certain road is called into the home office and coached on the methods and equipment to be used. Every phase of the entire contract is discussed with the job superintendent and his staff.

Field Organization

The job superintendent's organization is divided into six departments, each with an executive officer, who is usually a permanent employe. The department heads are: 1—Field accountant, 2— civil engineer, 3—master mechanic, 4—concrete foreman, 5—plant foreman, 6—grade foreman.

The field accountant has charge of all office records, cost accounts, pay rolls and material records. The civil engineer is a "staff officer," not directly in charge of any one department, but acting in an advisory capacity to all. To him are referred questions of layout, equipment and technical problems which arise during the progress of the work.

The master mechanic is in charge of the maintenance of equipment. His crew of mechanics keep the trucks and all mechanical equipment in repair. On all equipment except trucks the operator makes his own repairs, assisted by the repair crew.

The plan foreman is responsible for the storage of material, the mixing of concrete and the general upkeep of the plant. The concrete foreman is in charge of placing and finishing the concrete, and the grade foreman prepares the sub-grade.

A comprehensive accounting system is used on all jobs. Standard forms have been devised which tabulate the expenses incurred and the work done by each unit of equipment. Each truck is numbered and a daily record is kept of the number of trips made, the mileage, the amount and cost of gasoline and oil used, and the cost of upkeep. The labor and material entering into every item of construction is aggregated in such a manner that the cost of each operation is readily ascertained. Complete cost and progress records are sent to the home office at the end of each week. An inventory of all equipment is taken each month, when the depreciation accruing during that period is determined and written off.

On the Linn county job, a bunk house, containing 24 double-deck cots, and a commissary with five tables and a store, were maintained. The commissary was operated on a self-supporting basis and served about 150 meals each day at 35 cents per meal. Bunks were provided free with the meals. Scrupulous cleanliness was maintained in both the bunk houses and the commissary. In the commissary store overalls, working shirts, socks, tobacco, candies and soft drinks were sold.

Gasoline is Grading Better

Results of the semi-annual motor gasoline survey, just concluded by the United States Bureau of Mines, indicate that the average gasoline sold in the country is of a better grade than has heretofore been the case, is much more volatile than that sold two years ago, and has a somewhat better distillation range than last summer's samples.

Motor gasoline is also becoming more uniform in character. The large seasonal change is disappearing, but "winter gasoline" still has a lower initial boiling point than "summer gasoline." This difference in volatility is made intentionally to facilitate starting the motor in cold weather. The end point shown in the present survey is slightly lower either than that of last winter or of the summer of 1921.

The average of the entire country considered as a whole does not show much change from a year ago, but samples from individual cities show some distinct changes. Of 132 samples collected by the Bureau of Mines in the present survey 10 failed to meet federal specifications as regards the initial boiling point of 140 deg. F., and 61 samples failed at the 90 percent point (374 deg. F.).

First Jap Factory Turns Out 50 a Month

Promoted by William R. Gorham, American engineer, the Jitsuyo Jidosha Seizo Co., of Osaka, Japan, is turning out a light car, designed to replace the ricksha, at the rate of 50 monthly. The new car, socalled by courtesy, is steered with a bar, like an electric vehicle, and has no gear shift, the control being simply a small lever beneath the steering wheel which, advanced, performs all the functions of changing speeds, advancing the gas and spark and other necessary operations. It was designed to sell to coolies who have been drawing rickshas and has, therefore, been made "fool-proof."

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIV OCTOBER, 1922 NO. 7

1922 Output Looms Large

RECENT production figures, with estimates for the later months of the year, seem to show that the record total production figures established in 1920 will be approximated if not actually exceeded when all the figures are known for this year. The spring business was very good. Then came an exceptional summer, so good in fact that everyone, in the trade and out, predicted the usual fall slump. This failed to materialize and the figures for September now available show that the month this year exceeded the same month of last year by 30 percent.

Adding this total (205,405) to the previous total for the year through August (1,873,000), the two million mark has been exceeded already. This in itself exceeds the 1921 total by about four hundred thousand, and lacks but 130,000 of exceeding the record-breaking 1920. It would seem that October sales are holding up strongly as we write, that a production and sale of less than 300,000 for the three last months of the year can scarcely fail to be realized, so we may almost say a new record has been made.

The fact that another round of price cutting seems to be in prospect for the very near future, which would mean that cars will be much cheaper, which in turn will mean that more and more people can buy them, would seem to indicate that 1923 may be an even greater year. This would be particularly true if the many predictions as to increased business and greater prosperity for the coming year materialize. In prosperous years the automotive industry always does unusually well.

Ford Does It Again

ON OCTOBER 17, the country at large was astonished to learn that Ford has cut another $50 off the price of all his models. The previous prices were the lowest in the company's history, so this new cut means an even lower level, a price well below the lowest of pre-war prices. This new cut should widen the possible field of sales of Ford cars by many thousands. The new figure for the touring car is $298, f.o.b. Detroit.

Now that Ford has two real competitors in the Star and the Gray, it will be interesting to note whether these will cut their prices in a similar manner. Also but slightly above these three are the Chevrolet and Overland. It is freely stated in the trade that the competition of the two latter this summer was what brought about the Ford cut. Be that as it may all three have done tremendous businesses, the Ford company having passed the million mark, being now on a 5,000-a-day basis (which is at a rate of a million and a half), and having completed its plan for a 6,000-a-day basis on or before April 1, 1923 (which is on a 1,800,000 basis).

If the cars nearest to Ford should follow his lead in reducing the price, then the next higher class will feel the need to do likewise, with the result that the class above that will be obliged to take off the same amount and a little more, and so on. That is if its immediate competitors follow the Ford lead, there will be another round of price reductions such as there was a year ago.

Some will say that the splendid business of this year is directly traceable to the fact that all makes had reduced before the heavy spring and summer buying commenced and that these reductions, one after the other, and all widely published and commented upon, did more to stimulate the heavy buying than anything else.

Be that as it may, if we must have another such round of reductions, if the leaders now realize that such reductions must come, it is strongly to be hoped that they will be made all together and before the buying of and for 1923 begins, else the buying beginning generally at show time and gradually speeding up through the spring will be checked. In short, if you must cut, cut now and get it over with.

Increasing Popularity of Closed Body

Figures made public by the Cadillac Motor Car Co. show that in the last eight years production of closed cars in its plant has increased from 7 percent of the total to more than 54 percent of the total.

The increase has been a steady one, averaging a gain of nearly 8 percent each year. It covers the last six series produced. The greatest percent gain in closed bodies was from the period July, 1916, through June, 1917, showing a gain of 14 percent.

"It is generally believed that the high quality cars always produced a large percentage of their product in closed models," comments Lynn McNaughton, general sales manager, on these figures, "but these figures show that it is not so. In 1914 we produced but a negligible percentage in the closed models."

Garden Show for Overflow

William Wellman, who has promoted several successful events in Madison Square Garden, is considering leasing the building for an overflow automobile show to be held at the same time the national show is being held in the Grand Central Palace. Wellman figures that there will be a number of manufacturers of passenger cars who cannot get space in the Palace and who will be glad of a chance to show in the Garden instead of at the various hotels. It is likely he will include trucks and tractors as well as parts and accessories.

Motor Trucks on Eastern Farms

BY H. R. TOLLEY* and L. M. CHURCH**

Summary of the Farmer's Experience in the Eastern States, Showing the Size of Farms, Size of Trucks, Truck Advantages and Disadvantages

(Continued from Page 27, September Issue)

THE number of miles per year which a truck travels has a direct bearing upon the cost per mile run and per ton hauled, and the prospective purchaser should give careful consideration to the amount of use which he will have for the truck. The amount of material to be hauled. the size of the truck, and the length of haul will all have an influence on the distance per year which a truck will travel. Depreciation, interest, and repairs are all more or less independent of the number of miles which the truck travels per year, and the greater the number of miles traveled or the greater the amount of material hauled the less will be the charge per mile run or per ton hauled for these items.

According to the distances which their owners estimate these trucks travel annually the average distance traveled per year is 3,820 miles.

These men also estimated the number of days per year on which they use their trucks—not the number of full day's work which the truck does, but simply the number of days on which some use is made of it. On the average truck farmers use their machines on 160 days during the year, dairy farmers on 244 days, fruit farmers on 159 days, crop farmers on 127 days, and general farmers on 162 days crop farmers on 127 days, and general farmers on 162 days. and the crop farmers on the fewest.

Cost of Operation

First Cost. The average cost of the trucks of different sizes, including extra equipment, was $600 for the ½-ton truck, $1,306 for the ¾-ton, $959 for the 1-ton, $1,842 for the 1¼ and 1½ ton, and $2,465 for the 2-ton. Often the quoted price of a truck does not include some equipment which it is necessary or desirable to have, and nearly 75 percent of these men had purchased some such equipment. This varied from minor attachments costing only $2 or $3 to cabs and bodies costing as much as $200 or $300. Seven of these men had also purchased trailers for use with their trucks, but the cost of these is not included in the figures above.

It must be remembered that over a third of these trucks were purchased in 1917 or earlier and on that account the average first cost of the different sizes as given above is somewhat lower than the present prices (1921) of trucks of similar quality.

Life. The average life of all these trucks, as estimated by the owners, is 6.7 years. The estimated life of the ½-ton trucks is 6.6 years, ¾-ton trucks 7.1 years, 1-ton trucks 6.3 years, 1¼ and 1½-ton trucks 7.2 years, 2-ton trucks 7.9 years.

The estimate of the life of a truck depends not only upon the probable amount of work which it will do and the care which it will be given, but also upon the owner's idea as to when it will be cheaper to discard it and purchase a new one than to spend more time and money on it for repairs. There is quite a wide variation in the individual estimates on this item, but the averages will give the prospective purchaser a fairly definite idea of the amount of service he may expect from a truck.

Depreciation. The average first costs of the trucks of different sizes divided by the average life gives an annual depreciation of $91 for the ½-ton trucks, $184 for the ¾-ton trucks, $152 for the 1-ton trucks, $256 for the 1¼ and 1½-ton trucks, and $312 for the 2-ton trucks. The annual depreciation divided by the average number of miles traveled per year gives a depreciation charge per mile of travel of 2.4 cents for the ½-ton trucks, 4.2 cents for the ¾-ton trucks, 4.1 cents for the 1-ton trucks, 8.3 cents for the 1¼ and 1½-ton trucks, and 7.7 cents for the 2-ton trucks.

The depreciation per year and per mile will vary greatly for individual trucks, but these average figures at least show the importance of this item. For each size the depreciation charge as here given is greater than the combined costs of fuel and oil, and for the larger sizes it is greater than the combined costs of fuel, oil, and tires.

Repairs. The repair costs vary greatly with individual trucks, but the prospective owner will desire to know something as to what he must expect. Repairs will ordinarily be low for the first year or two of the truck's life. Forty percent of the men who had owned their trucks 12 months or less had spent nothing for repairs, and for no size had the repairs for machines which had been in use less than a year cost more than $20 on the average. However, very few men who had owned their trucks for more than a year had been free from expense for repairs.

About 100 men who had owned their trucks more than three years reported the cost of repairs. The average age of these older trucks was not far from four years, and the average annual repair costs to date for the ½-ton trucks had been about $35; for the ¾-ton trucks, about $50; for the 1-ton trucks, about $40; for the 1¼ and 1½-ton trucks about $35; and for the 2-ton trucks, over $100.

It is apparent, however, that these figures are too low for the average annual repair cost for the entire life of the machine. Based on present prices, a fair average for the repair costs covering the entire life of the machines would probably be something like $50 per year for the ½-ton trucks, $75 for the ¾-ton trucks, $75 for the 1-ton trucks, $100 for the 1¼ and 1½ ton trucks, and $150 for the 2-ton trucks.

Gasoline and Oil. The average number of miles per gallon of gasoline obtained by men who own trucks of different sizes is about 15 miles for the ½-ton, 12 miles for the ¾-ton, 11 miles for the 1-ton, 9½ miles for the 1¼ and 1½ ton trucks, and 8 miles for the 2-ton trucks. The average number of miles per quart of lubricating oil is about 60 for the ½ and ¾-ton trucks, about 50 for the 1, 1¼ and 1½-ton trucks, and about 40 for the 2-ton trucks.

These men were paying an average of 27 cents per gallon for gasoline and 65 cents per gallon for oil at the time of reporting (January and February, 1920). On this basis

* Agricultural Engineer. ** Assistant in Agricultural Engineering. Both with Department of Agriculture. Slightly condensed from Farmers' Bulletin 1201.

the total cost per mile for gasoline and lubricating oil was: For the ½-ton trucks, 2.1 cents; ¾-ton trucks, 2.5 cents; 1-ton trucks, 2.7 cents; 1¼ and 1½-ton trucks, 3.1 cents; and for the 2-ton trucks, 3.8 cents.

Tires. According to the estimates of these truck owners, the average cost per mile of tires, after making allowance for the tires with which the trucks were equipped when purchased and not including a charge for inner tubes for pneumatic tires, is 1.6 cents for pneumatic tires on ½-ton trucks, 2.9 cents for pneumatics on ¾-ton trucks, 1.6 cents for pneumatics on 1-ton trucks, 1.3 cents for solid tires on 1-ton trucks, 1.7 cents for solids on the 1¼ and 1½ ton, and 2.5 cents for solids on the 2-ton. A large percentage of the 1-ton trucks are equipped with smaller tires than those used on many of the ¾-ton trucks, thus making the average tire cost for the 1-ton size lower than for the ¾-ton truck.

The estimates of 318 men show that pneumatic tires on these trucks run an average of 4,500 miles and the estimates of 206 men show that solid tires run an average of 8,200 miles.

Average Cost per Mile. The average cost per mile of operating the trucks of different sizes, including charges for depreciation, repairs, interest on investment, registration and license fees, gasoline, oil, and tires, is 8.2 cents for the ½-ton trucks, 12.7 cents for the ¾-ton trucks, 11.9 cents for the 1-ton trucks, 19.0 cents for the 1¼ and 1½-ton trucks, and 20.3 cents for the 2-ton trucks.

Interest has been calculated at 6 percent on the average investment, such average investment being determined by the rule: First cost multiplied by years of service plus one and this result divided by the years of service multiplied by two.

These costs do not include charges for taxes, housing, insurance, labor of the owners in caring for and repairing the trucks, grease, and inner tubes for pneumatic tires. However, these items will ordinarily amount to only a small percentage of the total cost.

Cost of Hauling With Trucks

The cost of hauling with a truck is determined by the cost of operating the truck, the charge for the driver's time and labor, the size of load hauled, and the percentage of time which a truck runs without a load. The average time required for hauling, including loading and unloading the truck, as given by these men is 0.14 hour per mile of travel for the ½ and ¾-ton trucks and 0.15 hour for the 1-ton and larger. Under present conditions 50 cents per hour is probably a fair rate for the driver's time while actually at work.

These men have return loads for their trucks about 26 percent of the time; that is, on the average the trucks haul loads both ways on 26 out of every 100 round trips and run without loads on 74 one-way trips. The cost of operating the truck and the value of the driver's time for these 74 trips without loads must be charged against the 126 trips with loads in order to obtain the actual cost per mile of haul.

The average load of crops hauled with the ½-ton trucks weighs 0.48 ton; with the ¾-ton trucks, 0.93 ton; with the 1-ton trucks, 1.20 tons; with the 1¼ and 1½-ton trucks, 1.73 tons; and with the 2-ton trucks, 2.46 tons.

On this basis 50.2 cents is the average cost per ton mile of hauling crops with the ½-ton trucks, 33.8 cents with the ¾-ton trucks, 25.8 cents with the 1-ton trucks, 24.2 cents with the 1¼ and 1½-ton trucks, and 17.9 cents with the 2-ton trucks.

Kinds of Tires Recommended by Users

An important point on which the prospective purchaser of a truck must make a decision is the kind of tires which he will use, and here again the opinions of men who have had experience with trucks are especially valuable.

Thirty-six percent of these eastern truck owners now use pneumatic tires, 33 percent use solids, and 31 percent pneumatics in front and solids in rear. However, experience has convinced 50 percent that pneumatics are best for their conditions, 41 percent that solids are best, and 9 percent that pneumatics in front and solids in rear are best.

The kind which a man considers best depends considerably upon the size of his truck. Eighty-five percent of the owners of ½ and ¾-ton trucks think that pneumatics are best. The owners of 1-ton trucks are about evenly divided in their preference, and over 80 percent of the owners of trucks larger than 1 ton think that solids are best.

The choice of tires for any particular truck will, of course, depend not only upon the size of the truck but also upon the character of materials to be hauled with it, the amount of hauling to be done, and the kinds of roads on which it is to be used.

Reliability

The reliability of a motor truck, as that of any other farm machine, has a very decided effect upon its profitableness. If a truck is out of order at a time when its services are needed through a busy time, it can scarcely be considered a profitable machine. Likewise, if a great deal of time is lost on the road on account of motor and tire trouble, breakage, or other delays all the advantages attending its use may be overcome. In order to obtain information as to the reliability of motor trucks for farm use these truck owners were asked to give both the number of days their trucks had been out of running order when needed during the past year, and the percentage of lost time during use.

Seventy-one percent of the trucks had not been out of order at all when needed, 20 percent had been out of order five days or less, 6 percent had been out of order from 6 to 10 days, and 3 percent had been out of order over 10 days. In general the newer trucks are more reliable than the older ones. While only about 15 percent of the trucks which had been owned 12 months or less had been out of order for a day or more when needed, nearly one-half of those which had been in use more than three years had been out of order at some time during the preceding year.

Similarly, the newer trucks are more reliable in respect to the amount of time lost on account of motor and tire trouble.

Eighty percent of the men whose trucks had been in use 12 months or less stated that they had lost no appreciable time, but only one-half of those whose trucks had been in use more than three years stated they had lost no time. In all, 67 percent of the total stated that they had lost no time, and only one man in 26 stated that more than 5 percent of the time was lost on this account.

The average distance crops are hauled by these men is about 10 miles, and the average time required for the round trip is not far from three hours. A loss of 5 percent of the time on such a trip would mean a delay of about 10 minutes, and a loss of 10 percent of the time would be a

delay of about 20 minutes. Such delays, even with the trucks which give the most trouble in this respect, would scarcely be as serious as the loss due to having the truck out of running order several days when it was needed.

To a certain extent the reliability of a motor truck depends upon the ability of the operator and the care which the truck is given. Roughly, about 60 percent of these trucks are operated by their owners, about 30 percent by the sons of the owners, and about 10 percent by hired men. Automobiles are owned on about three-fourths of these farms, and tractors on about one-fourth of them. It is to be expected that the owner of such an expensive machine as a motor truck, or any member of his family, would give it a reasonable amount of care and operate it with a reasonable degree of intelligence, and the fact that automobiles or tractors were owned on a large percentage of these farms indicates that most of the operators were more or less skilled in the operation of gas engines. That such a large percentage of these trucks were operated without any loss of time, being always ready for work when needed, is very probably due in part to these facts. At least it is apparent that the man who has learned to operate an automobile or a tractor efficiently need expect little trouble from a motor truck.

The saving of time is given by these men as the greatest advantage in the use of a motor truck, but the saving will not be of any financial benefit to a farmer unless he uses the time thus saved or unless it enables him to reduce the amount of hired help.

These men were asked whether or not their trucks reduce the expense for hired help, either man or horse; and if so, to estimate the amount thus saved per year. Of 711 men who answered the question 562, or 79 percent, said that the truck did reduce the expense of this item, and the remaining 149 said that it did not.

Three hundred and fifty of the 562 estimated the amount thus saved, and the average of these estimates is $324. This figure can scarcely be taken to represent the actual amount which their labor bills have been reduced since purchasing their trucks, but rather as an average of the estimates as to the amounts by which their bills would be increased at going rates for labor if they did not now own trucks, and if they were doing the same amount of work they are now doing.

Eighty-four percent of the operators of fruit farms think that their trucks reduce the expense for hired help. This is a slightly higher percentage than is reported for any other type of farming. The average of the estimates of those of this 84 percent who attempted to place a value on the amount of help saved is $364.

The owners of the larger trucks make higher estimates of the amount that their trucks reduce expenses than do those who own the smaller ones. The averages of the estimates of the owners of the ½, ¾, and 1 ton trucks who report that their trucks reduce the bill for hired help were between $250 and $300, the average of the estimates of the owners of the 1¼ and 1½-ton trucks was between $375 and $400, and the estimates of the owners of the 2-ton trucks and of those over 2 tons averaged more than $600. There is no great difference in the percentage of the owners of the different sizes who consider that their trucks do not reduce the expense for hired help.

Displacement of Horses

The operators of 610 farms reported the number of head of work stock they owned before purchasing their trucks and the number they had disposed of since that time. Four of these 610 were small farms, which had been operated without horses even before trucks were purchased. The number of head of work stock kept on the other 606 farms varied from 1 or 2 on the smaller farms to 20 and more on a few of the larger ones. The total number kept on the 606 farms was 3,103. On over one-half of the 606 farms no change had been made in the number of head of work stock kept since purchasing the trucks. On 296 of them the number had been reduced, since the trucks were purchased, by a total of 586 head, an average reduction of 19 percent and an average displacement of a little less than one head per truck purchased.

A man with only one or two horses will usually need to keep them for work on the farm even after buying a truck, and only about one man in seven who owned one or two horses had sold any since buying his truck. Similarly, the purchase of a motor truck will not ordinarily enable a man who owns three or four horses, all of which he sometimes uses as a single unit, to reduce the number of his work stock. A little less than one-half of the men who had owned three or four horses before purchasing their trucks reported that they had disposed of any since that time, but nearly two-thirds of those who had owned five or more had disposed of at least one after purchasing the truck.

As only 55 of the 606 men disposed of more than two head of work stock, it appears that only rarely will the purchaser of a truck be able to dispose of enough horses to pay for it. Although the use of motor trucks on the larger farms makes it possible to dispose of some of the work stock, it is apparent that on the smaller farms the truck more frequently supplements rather than supplants the horse.

This displacement of horses by motor trucks is quite comparable to the displacement by tractors in this section. A study of 252 New York farms on which tractors are owned, as reported in Farmers' Bulletin 1004, "The Gas Tractor in Eastern Farming," showed that on these farms the total work stock owned when the tractors were purchased amounted to 1,321, while the total after the purchase of tractors was 1,018, a reduction of 22 percent and an average displacement of 1.2 head per tractor.

Work Stock on Farms Where Both Trucks and Tractors Are Owned

Over two-thirds of these farms, where trucks are owned, consist of not over 120 crop acres. Tractors are owned on only about 15 percent of such farms, while they are owned on 55 percent of those with more than 120 crop acres. In most cases the reports did not show the size of the tractor owned, but at least a part of the tractors owned on the small farms are of only one or two draw-bar horsepower, and are capable of doing the work of only about one horse.

The ownership of both motor trucks and tractors, even on the large farms, has not resulted in a very great reduction in the number of horses. Forty-seven men, who own both trucks and tractors, and who have from 61 to 120 crop acres, keep on the average nearly four horses—one horse for each 24 crop acres—and only six of them are farming with fewer than three horses; 42 men who have from 121 to 180 crop acres keep an average of five horses—one for each 30 acres—and only six of them are now farming with fewer than four horses. Seventy men, who have over 180 crop acres, keep an average of between eight and

(Continued on Page 27)

How to Paint on Zinc

METAL sheets are being used more and more in automotive as well as general construction, and it is important to the painter to know how to paint them. No form of sheet metal causes him more trouble than zinc or zinc-coated sheets because oil paint does not last long on these. It peels, cracks and finally falls off in flakes. Some assert that this is due to the too great smoothness of the metal, which prevents the paint from adhering properly; others believe that the cause is the oxide formed on the zinc. But this is scarcely the source of the trouble, as we paint other smooth metals on which paint lasts very well, and the oxide produced frequently forms an excellent bond between the paint and the metal.

The real cause of the trouble is quite different. It is the fact that zinc has a higher co-efficient of expansion than oil paint or varnish. The coefficient of linear expansion of zinc is .001 for 30 deg. C.; i. e., a strip of zinc 1 meter long lengthens 1 millimeter when the temperature is raised 30 C. deg. This is an enormous expansion and is not equalled by any other metal or by ordinary oil paint. The result is that ordinary oil paint cannot follow the expansions and contractions of the metal, so that the paint is obliged to crack and peel.

Hence the preparation of paint to be used on zinc should be carefully supervised; its composition should be so adjusted that it has nearly the same coefficient of expansion as zinc. Also, the paint must be so compounded that it will remain elastic. Hence, the painter should use zinc white or zinc gray as basic pigment, and add varnish as medium. Such a paint will be more elastic than any orinary oil paint.

Zinc Requires No Protection

paint to protect it from oxidization. In time a very thin gray coat of zinc oxide forms on it, which protects it admirably from attack by the weather. In most cases, zinc is painted for decorative purposes, and not for protection.

The purpose of pickling zinc in acid is not, as many painters imagine, to remove the zinc oxide on the metal, but simply to take off any dirt and traces of grease that may be present, and also to roughen the surface. The zinc oxide on the metal causes the paint to adhere better.

Potassium silicate paints are also very good for covering zinc and are very durable, because the silicate combines chemically with the zinc and adheres to it very firmly. This paint is always best for painting the interior of iceboxes, which are usually lined with zinc.

Silicate paints are prepared with potassium silicate (which is to be preferred to sodium silicate) diluted with rain or spring water, and zinc white or zinc gray and a small quantity of barytes. The pigments used to tint it are the same as those used for whitewash.

Thin Even Coats Needed

All paints on zinc, both oil and varnish, should be put on thin so as not to have more paint in one place than another.

To get good results, the coats of paint should be dried in a drier heated to 60 or 65 deg. Reaumur (75-79 deg. C.), for at least nine or ten hours. But, as most painters do not have an enameling furnace, it is necessary to carry out the painting in the way described below:

Before painting, it is well to scrub the zinc to remove all traces of grease, and at the same time to remove the polish of the metal and make it rougher so that the paint will adhere well.

This scrubbing is done with hydrochloric acid and a little water. Moisten a rag with this, sprinkle sand (preferably sharp sand) on it and rub the inside and the outside of the tub till the zinc has become rough. This done, wash thoroughly with much pure water so that no further trace of the acid remains in any angle or corner, as this might corrode the metal too severely.

The preparation of the metal is not finished even after that. The zinc is still too polished, and the paint will not adhere sufficiently. The metal must then be rubbed with pumicestone, sand and water, principally on the inside of the tub; the outside is less important. After the tub has been thoroughly scraped with the pumice, it should be rinsed out with water frequently renewed. It is then dried and dusted off just before painting.

The first coat should consist of enamel varnish cut with spirits of turpentine. The following coats should also be kept thin, but a little more turps should be added to the enamel varnish for each coat. The coats should be applied so thin that four coats give a well-covered and smooth surface. The bath tub should be dried for at least 15 days before use, and, in using it, it should always be filled 15 centimeters deep with cold water before adding the hot. Never put hot water in first, as this destroys the enamel varnish.

Giving Zinc the Appearance of Copper

As was said above, zinc is painted for ornament and not for protection, as there is absolutely no need of protecting this metal; it protects itself by the coat of oxide formed on its surface. But architects and customers frequently ask painters to remove the gray tint of zinc ornaments on houses, etc., and give them a copper platina.

This cannot be done either by applying a coat of copper-leaf or by electroplating. A solution of copper dissolved in nitric acid is used. The part to be copperplated is first washed with very strong and very hot soda solution to remove all traces of grease; it is then rinsed with pure water and dried. The copper is then applied heavily on the part to be copperplated. The copper coat is covered with varnish to protect it from wear and weather.

To give the copper an artificial platina, treat it with dilute acetic acid. A coat of verdigris will be formed in a short time, which should also be covered with a protecting coat of varnish.

Gilding Zinc

This account would be incomplete if gilding zinc were not mentioned, as there are numerous zinc articles, such as weather-vanes on towers, which are nearly always gilded with gold leaf.

The preparatory work is the same as that described above. The primer coats are then laid on with paints with zinc white or zinc gray as pigment and varnish (flatting varnish) as medium, till the metal is well covered. Then the coat is carefully rubbed with very fine sandpaper. After this, dust off and gild as usual.—By P. Guillaume, in Le Moniteur de la Peinture.

Mexico imported during 1921 from the United States 6,234 passenger cars and 1,500 trucks. These purchases made Mexico for 1921 the best market, Canada following a close second.

Golden Anniversary of the Carriage Builders' National Association

The golden jubilee anniversary of the C. B. N. A., held at the Hotel McAlpin in New York City the week of Oct. 9 reminded one of old home week, to which the oldtimers flocked, celebrating the event with handshaking and reminiscences. Many were present who had not attended a C. B. N. A. convention for years.

The business meetings of the association were held on Tuesday and Thursday mornings.

In addition to President Ebrenz's address on Tuesday morning, there was a letter from Secretary Emeritas Henry C. McLear, in which he extended greetings and gave an extended account of the history of the association. Mr. McLear regretted that his state of health did not permit of his attendance.

Mr. Pierson, representing the U. S. Chamber of Commerce, addressed the convention on general conditions and prospects of trade abroad.

Mr. E. E. Hughes of Lynchburg, Va., was nominated for president of the association for the ensuing year and the chair appointed the usual nominating committee for the remaining offices.

A very interesting paper on varnish was read by Mr. Pulsifer of Valentine & Co., which will appear in the November issue of Automotive Manufacturer.

Mr. Charles E. Adams of the Cleveland Hardware Co. closed the session with one of his entertaining talks.

Thursday's meeting was addressed by Mr. Hilder Jacobs, president of the Institute of British Carriage & Automobile Manufacturers.

The balance of the morning was devoted to the election of officers, selecting the place of meeting for 1923, and reports of committees.

A vaudeville performance was provided for Tuesday evening, consisting of music by a male quartette, monologs and fancy dancing.

The annual banquet on Thursday evening was presided over by Mr. Ebrenz. Grant Wright was the only speaker scheduled and he made a very pleasing address. Mr. Jacobs of the British Institute, gave an intimate picture of conditions in industry as they existed in England during the war.

Among those at the speakers' table were Col. E. W. M. Bailey, Daniel T. Wilson, F. P. Judkins, Teo. Luth, past presidents of the association, and Wm. Brewster.

C. B. N. A. Exhibitors

There was a pretty fair line of exhibits which were arranged in better form and perhaps more artistically than at any previous convention of the association. The list follows:

Valentine & Co., New York City.
Goodyear Tire & Rubber Co., Akron, O.
Laidlaw Co., New York City.
Illinois Iron and Bolt Co., Carpentersville, Ill.
Mutual Wheel Co., Moline, Ill.
Cleveland Hardware Co., Cleveland, O.
Sheldon Axle & Spring Co., Wilkes-Barre, Pa.
Auto-Vehicle Parts Co., Cincinnati, O.
St. Mary's Wheel & Spoke Co., St. Marys, O.
Hopkins Manufacturing Co., Hanover, Pa.
L. C. Chase and Co., Boston, Mass.
Queen City Forging Co., Cincinnati, O.
Ames Body Corporation, Owensboro, Ky.
Columbus Bolt Works Co., Columbus, O.
C. C. Bradley & Son, Syracuse, N. Y.
Eberhard Manufacturing Co., Cleveland, O.
West Tire Setter Co., Rochester, N. Y.
Brewer-Titchener Corporation, Cortland, N. Y.
Kelly-Springfield Tire Co., Cincinnati, O.
Owensboro Wheel Co., Owensboro, Ky.
Monarch Carriage Goods Co., Cincinnati, O.
Owensboro Forging Co., Owensboro, Ky.
Mossman Yarnelle Co., Fort Wayne, Ind.
Edward F. Alf Co., Cincinnati, O.
D. Wilcox Manufacturing Co., Mechanicsburg, Pa.
Wood-Smith Co., Chicago Heights, Ill.
Raser Tanning Co., Ashtabula, O.
Mitchell Wheel Co., Miamisburg, O.
Price Varnish Co., St. Louis, Mo.
Pioneer Pole & Shaft Co., Piqua, O.
Chas. Scotson Co., Cincinnati, O.
The Spokesman, Cincinnati, O.
Ware Bros. Co., Philadelphia, Pa.
Blacksmith & Wheelwright, New York City.

Large Increase in Light Car Production

Of the 1,507,465 passenger automobiles made in the first eight months of this year 697,430 were Fords, leaving 810,035 as the "all other." If we assume production in the last four months of the year will equal three months of average production in the eight months the year's total will be 1,113,797. Production "all other" in August was 124,719. If we assume production in the last four months will be three times the August rate, the year's total will be 1,184,192. The mean of these two guesses is 1,149,999, and we may take 1,150,000 as a reasonably trustworthy working figure.

The maximum production of passenger automobiles other than Fords was 1,177,520 in 1920. The second best year was 1917, with 1,133,691. Production even in 1916 was 1,059,688.

In other words, the production of cars other than Fords has not materially increased in five or six years. Furthermore, among the "all other" there is a much larger proportion of the lighter and cheaper cars than formerly. Chevrolet passed into the thousand a day class about five months ago. Other light cars are being made in much larger numbers than in 1916 and 1917. Beyond all question the buying of medium weight and medium priced and heavy and high priced automobiles has very materially decreased in the past five or six years.—American Metal Market.

Nickel Steel in Auto Cars

The importance of nickel in the automotive industry is made prominent at the Detroit Automobile Show. Since the earliest days of the automotive industry, steel containing nickel has played an important part in the successful construction of cars. Nickel bearing steels are used today in 74 automobile parts. Brake release rods, crank shafts, piston pins, propeller shafts, axles, steering knuckles, valves, and starting clutches are a few of the parts made of nickel bearing steels. The prominence of nickel in the industry is also attested by the fact that in the construction of 92 passenger cars and 137 motor trucks nickel alloy steel is used.

Carburetor Tests Results May Be Far Reaching

W. S. von Bernuth, Br., Ph.B., Personal Assistant to the Dean of Engineering, Purdue University; Member A. S. S. E.

NO ONE will dispute the need for conservation of our petroleum resources. In 1921 the United States produced 465,000,000 barrels of crude petroleum. The same year we consumed 516,000,000 barrels which necessitated the importation of 51,000,000 barrels.

Our total supply of crude petroleum resources is approximated at 5,000,000,000 barrels. Huge as is this sum, it can readily be seen that at the present rate of consumption our supply will not last long.

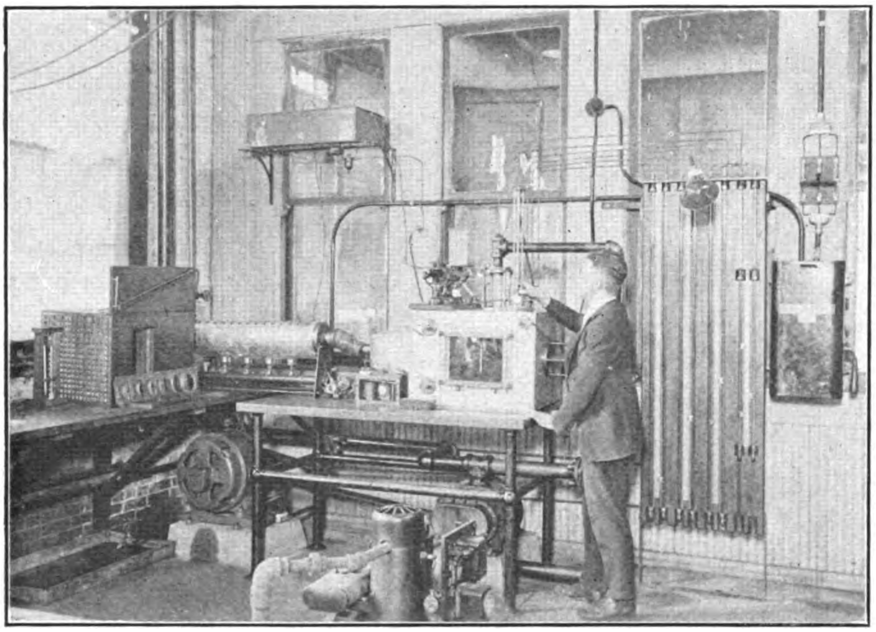


Fig. 1. General view of experimental laboratory in which carburetor testing was done, and showing apparatus developed for this purpose

The future is not so dark, however, as the above figures would at first glance lead us to believe. There are other means of increasing the supply. The vast deposits of oil bearing shales in Colorado and Indiana are waiting for some cheap process for the extraction of the oil. These two states together could, it is estimated, supply the country with oil for at least 100 years. The second method of increasing the oil supply of the country is by getting more power and mileage per gallon from it.

It was the idea in mind of definitely establishing the best method of fuel preparation, and to give carburetor designers the fundamental information concerning the fuel-air ratios required by an engine for high power and efficiency, that Purdue University has attempted to solve some of the problems. The work is in charge of Claude S. Kegerreis, M.E., and rapid progress has been made. The experimental apparatus is of Mr. Kegerreis' original design, and embodies some novel features. A description of the plant follows.

To quickly and efficiently determine the worth of any carburetion device some means of testing, which is independent of the power plant, is desired. The plant not only needs to be flexible in the testing of carburetors but also in the development of any component part, and to measure the flow of fluids, including both air and various fuels. One of the requirements for the testing of carburetors is that the pressure at the outlet is the same as if the carburetor were placed on an engine. The pressure on the fluids, especially at metering, and also when studying the operation at various altitudes, must be the same.

With these requirements in mind a plant consists in the main of:

1. Main air chamber.
2. Vacuum blower and electric motor.
3. Air heater.
4. Air meter.
5. Fuel flow meter.
6. Fuel weighing apparatus.
7. Manometer board.
8. Air flow control.

The main air chamber consists of a two-ply wooden box 18 x 18 x 30 in., covered with an air tight metal container. The chamber is designed to withstand high vacuums for altitude work and for vaporization research. The box is provided with two flanges for mounting either top or side outlet carburetors and other apertures allow for air inlet, manometer taps and door for mounting and inspection. All controls are brought to the outside enabling ease of adjustments.

The air before entering box is induced through a heater and meter. The gas heater is of a horizontal boiler tube type allowing ample heating surfaces for temperatures up

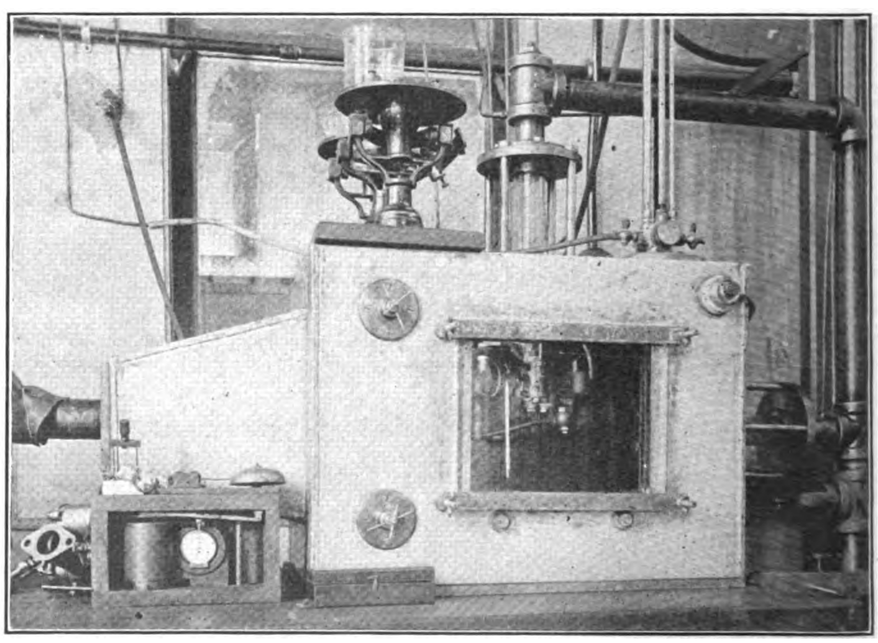


Fig. 2. Detail of special carburetor for testing apparatus, showing main air chamber box. This is air tight and designed to withstand a high vacuum

to 500 deg. F. The tubes being of sufficient size and number allow a high flow of air with only a small pressure drop. The temperature control is such that under any air flow the regulation is within plus or minus 2 deg. F.

The air is metered by means of various orifices, the difference in pressure on the two sides being limited to less than 6 in. water drop. The data published by Durley was applied in this design. The meter in the main consists of a grid baffle to eliminate eddy currents beyond the critical area, a removable orifice, a pressure chamber and a mano-

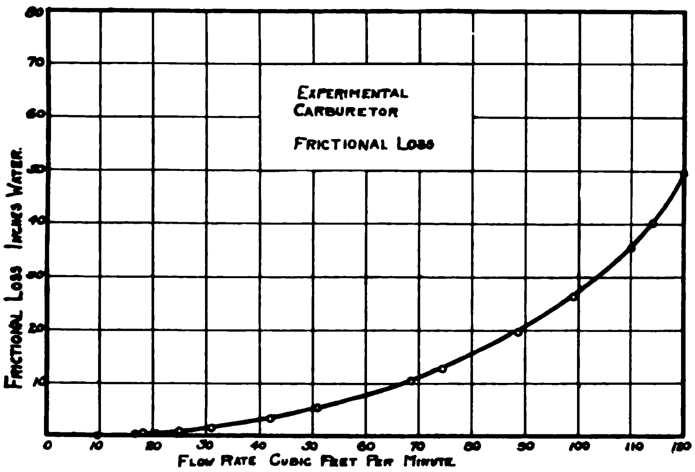


Fig. 3. Curve to show metering characteristics for change of load at four different speeds

meter or draft gauge for measuring the flow. Several orifices are used and their respective calibrations are graduated on the manometer scale directly in cubic feet per minute.

Fuel Measurement. The fuel may be measured by two different methods, i. e., by means of balances and by the use of a flow meter. The direct method of weighing is employed when extremely accurate results are necessary. For ordinary operation the flow meter is of sufficient accuracy. The meter consists of a series of orifices especially designed for a wide flow rate and to allow an overlap for checking one orifice against another. The fuel head on these orifices is held constant by means of a float valve and chamber. Glass tubes on the discharge side of the orifices allow the change of bead due to flow to be read. By means of calibrated scales the fuel flow is read directly opposite the meniscus of the fuel level. The fuel is conducted from the meter through the supply taps into the device in the air chamber.

The air flow is induced through the air chamber by means of a rotary vacuum pump. The air control is such that any volume of air, under any vacuum comparable to engine conditions can be obtained. This control is necessary in some types of carburetion devices.

The manometer board is arranged with eight tubes, six for water and two for mercury. The mercury tubes are cut in parallel with water tubes for accuracy at the lower heads. The manometer scales are set at zero and no correction is necessary because of the overflow in the water reservoir. The mercury adjustment cannot be made in this manner so a tank with sufficient surface area is provided to allow no appreciable change in the zero level. The board carries verniers to enable all readings to be recorded with an accuracy of one hundredth of an inch.

The testing plant is in some respects similar to the one in operation at the Bureau of Standards. The greater portion of the plant was built by the university shops from the design by C. S. Kegerreis of the Engineering Experiment Station.

A complete test of a carburetion device can be quickly made on this plant and the relative power and efficiency values of such an instrument can be readily determined in a test of this type, as on an actual engine. It is the mixture ratios delivered and the friction loss in the device that tells the story. In addition to this, glass inspection tubes are placed at the outlet of the air chamber to note fineness of atomization.

The plant is not limited to merely commercial testing and development but researches of the more fundamental types may be made thus allowing a wide field for the plant.

The curve sheets show the metering characteristics for change of load at four different speeds and the friction loss through an experimental carburetor of 1¼ in. actual size. The data is comparable to that taken on an engine as it compares favorably with the block results. It might be interesting to state in connection with these mixture ratios shown in the plot that satisfactory acceleration is present when wished, the ratios returning to the lean values on constant speed or load operation.

London Preparing for November Exhibit

The Society of Motor Manufacturers and Traders is making plans for the 1922 motor car exhibition, to be held at the White City and Olympia, in London, Nov. 3 to 11, inclusive. Owing to the fact, it is said, that the general industrial situation of the country does not warrant a Commercial motor exhibition this year, manufacturers will concentrate upon the November display, and no efforts will be spared to make this exhibition the most interesting and comprehensive of any show so far held in the United Kingdom.

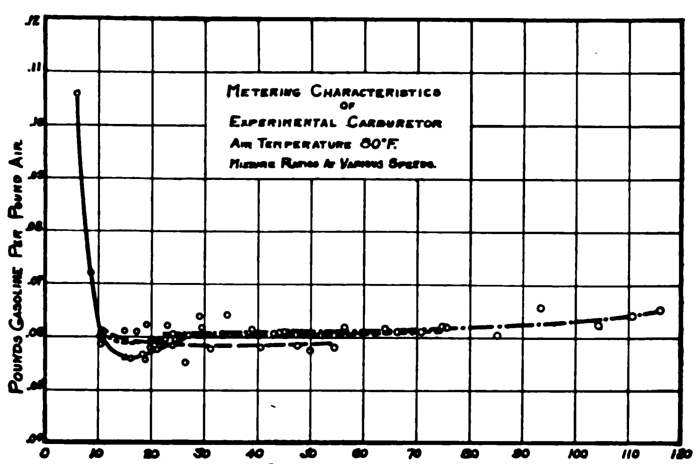


Fig. 4. Curve to show friction loss through an experimental carburetor 1¼ in.

Ford to Quit Manchester; Buys Site at Southampton

The Ford Motor Co. in England has concluded arrangements to acquire 20 acres of land alongside a deepwater quay at Southampton for the erection of a plant which will displace the one now at Manchester, where the lease expires in a few years' time. The new plant will form the headquarters for European distribution, and it is hoped to have the building completed and the plant in operation within a year.

Bodywork After Collision

The examination of a car, after it has suffered collision, reveals many interesting facts as to how the bodywork stands up in cases of this kind. The first thing which will be noticed is the high degree of safety which is afforded by the use of metal panels. The rear panel, for instance, may be badly dented in several places and even torn away here and there from the retaining screws, or pulled away entirely from its groove in the elbow rail, but it is only on rare occasions that it is actually pierced. Under the same conditions a mahogany panel would most likely be badly splintered and broken away, and the trimming work dislodged, entailing some measure of injury to the passengers. When the panels are badly distorted the ash framework will of course be split and have to be renewed, but it is seldom that it has moved far from normal position.

The motor body builder is occasionally mystified as to the reason why paint flakes off from a panel which has been well prepared with the best material under good workshop conditions, but it is even harder to understand perhaps why the paint surface will often be unbroken, though of course severely rubbed and grazed in places, where the panel has been severely dented. It tends to prove, says Automobile & Carriage Builders Journal [London], that modern painting processes, such as are embodied in the best class of work, insure the building up of a skin or covering which does not lack in elasticity. Where the panel is torn away from the framework at the edges, one also gets the opportunity of noting the total thickness of the paint film which for the best work should not be less than 1/32 of an inch. Since the fashionable style of back panel is one without any vertical mouldings, this panel will often be in one piece from door to door, so that the job cannot be carried out cheaply. If anyone considers this a cause of complaint it is most likely that the insurance companies concerned would consider they had a grievance. If the motorist was not in the habit of insuring his car then no doubt he would take steps to insure a style of construction and embellishment which could be cheaply repaired. If any difference of opinion is likely to arise it may be in regard to the amount of repainting required. Even a small graze on a back panel means that the whole must be done again, since the least that can be done is within a defined panel area such as is bounded by moldings, beads, door plate, and so on.

When estimating for the repair of a damaged panel one is often in competition with other firms, so that the most economical method of putting it right must always be kept in view. A small dent can often be replenished into shape without taking the panel off altogether if one can get at it, after removing the lining, for using the necessary tools. If it is a side panel and the damage is near the standing pillar, the edge should be released from the pillar and along the waist rail, because, after it has been beaten into shape again, it will be found that the panel has most likely been stretched so much that there is, say, a quarter of an inch to spare which has to be trimmed off before it is refixed. A steel panel will often stretch this amount, and an aluminum one, of course, more so. For this reason it is not worth while attempting to replenish badly dented panels, even if unbroken, since the amount of stretching entailed means that practically no labor would be saved by reshaping the old metal while, at the same time, the panel would be too thin in many places to stand up to the required shape.

Mud guards are damaged in nearly every collision, whether serious or otherwise, so that one has to judge chiefly whether they can be repaired or must be replaced. Slight dents may sometimes be taken out of flat mud guards without removing them by means of a piece of wood and mallet. The mud guards, however, will have to be removed usually for repainting, while the hind ones, even if undamaged, have to be taken down if the side or back panels need attention.

A motor body builder in inspecting a body may wonder if the panels to be repaired are steel or aluminum. The paint may be in good condition so that it is not at once apparent which metal has been used. Since the panel has to be replaced or repainted there is no harm done in removing with a knife the entire paint surface from a small place near the edge, when, if aluminum, the characteristic silvery surface is revealed. Moreover, the knife marks the metal easier than with steel. But one has to bear in mind that mere softness is no criterion, since lead-coated steel might fulfil these conditions. Another test is to examine carefully the edges of the panel, and, if it is aluminum, where the edges are broken away from the moldings or framework there is almost sure to be a certain amount of a white powdery substance visible. This is the carbonate of aluminum and is formed by the reaction of the air on the metal. With iron the familiar red oxide or rust is formed. Aluminum panels also dent more easily, and often long and pointed disfigurements are set up which would be impossible to form in the same way with steel. Also any loose paneling yields to the touch more easily and there are occasions when one may see a large portion of the inside surface which has only been primed or not even painted at all, when the characteristic appearance of the metal will be noted. If the car has been panelled in aluminum the insured customer is justified in expecting a similar material to be used when replacing, and it should be definitely mentioned in the estimate for repairs.

A collision which has occurred to the back of the car will usually damage the tank also if it is placed at the rear. A small round hole or holes about the center line of the tank shows that the baffle plate has been dislodged. To remove any dents or to patch a hole the end has to be taken out apart from disconnecting it. Lamps commonly suffer. Glasses have to be replaced, the rim and body hammered back into shape, new bulbs provided since the filaments are often broken, and the lamp brackets reset. This work, although it may be tackled by an experienced hand in the panel-beating shop, is best undertaken by a specialist in lamp repairs.

A troublesome matter to price accurately is when many of the main joints of the body have been badly strained and the doors require rehanging. The matter would be easier to decide if one were able to remove all the adjacent panels and trimming before giving a price. The engineer, when he is asked to overhaul a chassis, usually refuses to give a price unless he has a chance of thoroughly examining the parts, the cost of dismantling being borne by the customer. As matters now stand the carriage builder has to rely entirely on his judgment and experience as to how much labor is entailed from the outward appearance of the body. Still, when making out his estimate he will of course allow for the time taken up in removing good and broken parts. Also, when pricing up the labor, a small margin should be allowed for con-

tingencies over and above the figure given by the works manager or foreman bodymaker.

As already mentioned, the customer will often expect the whole car to be repainted when the damage only entails partially doing so, usually on the plea that the new and old colors will not match. The motor body builder, however, may seek to effect a compromise by suggesting that he will reglaze the undamaged parts and revarnish the whole for so much extra, this item being carried out at the customer's expense.

Repair work of all kinds is well worth the close attention of every firm in the trade, since it helps to keep the shops going when orders for new work are not plentiful. On the whole it requires more experience in estimating and more skill and judgment on the part of the workman concerned, than with a new job. If repairs can be carried out promptly and at attractive prices, coupled with a moderate amount of publicity, there is no reason why a far greater number of motorists should not be tempted to maintain the car in better condition than now obtains.

Closed Car Show a Great Success

(Continued from Page 13)

There were several new lines and models introduced recently to the trade which attracted their full share of attention. These included the new Peerless, new Cadillac victoria and five-passenger coupe, new Buick lines, Dodge Brothers business sedan of steel, Moon "6-40" sedan, Nash five-passenger sedan on the shorter of the two six-cylinder chassis, Star coupe and sedan, new Cole "890" closed cars, Earl cabriole, new Gardner coupe and sedan, and seven-passenger Willys-Knight sedan, among others.

The many established products, with which the trade and public are familiar, shared with the new offerings in the public's measure of recognition. For example, there were such popular closed cars as the Hudson coach, Essex coach, Nash four cabriole, standard Maxwell closed models, Oakland and Chevrolet business coupes, Dort low-priced closed jobs, Jordan brougham, Standard's improved types, Overland's recently reduced models, Rickenbacker, the new Stearns-Knight six, and Kissel with custom coachwork.

Custom Bodies Shown on Low-Priced Chassis

Prominent among the custom body jobs on chassis not generally so employed, was a four-passenger Hupmobile sedan, $3,200 delivered in New York. Shipped on special order by Hupp, it was exhibited by the Van Alstyne Motor Corp. This has a Reiss (Detroit) body on a chassis lengthened to 126-inch wheelbase. Equipment included in the price mentioned includes six polished aluminum Disteel wheels, trunk rack and rails, two extra tires, C. G. front and rear bumpers, nickeled radiator and lamps, individual steps, Warn-O-Meter and parking lamp on top of body at the front. Finish is in maroon and black.

Stratton-Bliss Co., Dodge Brothers distributer, exhibited a four-passenger coupe with United body, selling at $1,950 in New York, and a Babcock town car similar to that first shown at last year's show. The coupe is trimmed in brown leather and has a divided full-width rear seat and two individual tilting chairs.

Unusually attractive was the seven-passenger vestibule-sedan on a longer Nash six chassis, exhibited by the Warren-Nash Motor Corp. This has a Bridgeport body, and sells for $3,500, delivered in New York.

Sherwood Automobile Corp. showed a special seven-passenger suburban on a 124½-inch wheelbase Jordan chassis. This is also a Bridgeport body and retails for $3,650, New York delivery.

Another frequently-commented-upon special job was found at the stand of the Hudson Motor Car Co. of N. Y. It is a collapsible brougham, $4,945 delivered in New York.

Custom-built jobs were shown on practically all of the higher-priced lines. Among them was a Healy cabriolet on a Cadillac chassis. Packard showed a Farnham-Nelson limousine-brougham on the twin-six. The Daniels was shown with its justly famous coachwork, as were the Rolls-Royce, Pierce-Arrow and Cunningham.

Few California Tops

Three open cars were shown with California tops. These were Oldsmobile, Stutz and Oakland Sport. The Stanley, the only steam car in the show, was shown with a luxurious seven-passenger sedan body.

All these enclosed jobs, varying from the lowest possible price (there were several less than $1,000) up to the utmost of comfort and elegance (at prices approximating $10,000) had their following of interested, buying people. It was a good show, well staged, well atended by large numbers, and it would not be surprising if it were made an annual, national affair. The New York dealers have petitioned the National Automobile Chamber of Commerce to do this, and within that body there is strong sentiment for such action.

Motor Trucks on Eastern Farms

(Continued from Page 21)

nine horses—one for each 39 crop acres—and only three of them are farming with fewer than four horses.

The number of crop acres per horse on the farms of different sizes, where trucks, but not tractors, are owned, is only about two acres less in each case than on the farm where tractors are owned, there being 22 crop acres per horse on the farms with 61 to 120 crop acres where tractors are not owned, 28 per horse on those with 121 to 180 acres.

A Non-Burning Exhaust Manifold Paint

A rusty exhaust manifold is unsightly, to say the least, and the manifolds on most car engines get rusty after a short period of use. Various methods of rustproofing this part have been tried, but apparently with little success. A new paint for manifolds, known as Kemick is now being offered by the American Chemical Paint Co., and is claimed not to burn off. It is a black paint and is said to retain its color and stay in place even if the exhaust manifold gets red hot.

The paint consists of a pigment held in a liquid vehicle or binder. When heated the liquid evaporates and the pigment reacts with the iron of the manifold and form a coating which prevents rust and adheres strongly to the iron itself. A quarter pint of the material is said to be sufficient for the exhaust manifold, exhaust pipe and muffler of four or six-cylinder cars.

Before the paint is applied, all oil, grease, old paint and loose scaly rust must be removed from the surface, by means of a wire brush, stiff scrubbing brush or sand paper. Before applying the paint should be thoroughly stirred, and it can be applied either by means of a brush or spray. Kemick is not an outside paint, and when exposed directly to the weather should be protected by a weather-proof paint.

Fisher Body's Expansion Program

Fred J. Fisher, president of the Fisher Body Corp., Detroit, announces an expansion program involving assembly plants at six points in the United States, aggregating more than one and a half million square feet of additional floor space, which will be devoted exclusively to the manufacture of Chevrolet closed bodies.

The corporation through a newly organized subsidiary, the Fisher Body St. Louis Co., has taken over the large General Motors Buick plant, in St. Louis, which will be devoted exclusively to the manufacture of closed bodies for the "superior" Chevrolet.

This announcement follows closely upon the acquisition of the O. J. Beaudette Co. at Pontiac, Mich., which will be devoted exclusively to the production of open bodies for the Chevrolet.

As the greater part of the Cleveland plant is devoted to Chevrolet production, this will make a total of three plants with a joint floor area of over three million square feet.

In addition to these three manufacturing plants, six new plants are in process of construction, for the sole purpose of assembling, painting and trimming bodies for the "superior" Chevrolet models.

These assembly plants will be operated in part by the Fisher Body Ohio Co. of Cleveland, O., and in part by the Fisher Body St. Louis Co. of St. Louis, Mo. The assembly plants to be located at Flint, Mich., Buffalo, N. Y., and Cincinnati, O., are to be under the supervision and operation of Fisher Body Ohio Co., and those at Oakland, Cal., and Janesville, Wis., together with the plant at St. Louis will be operated as the Fisher Body St. Louis Co.

In an interview Mr. Fisher stated, "The tremendous growth in the demand for the "superior" Chevrolet closed cars, has compelled us to open plants adjoining the various Chevrolet assembly plants in order to give the Chevrolet much better service and enable us to turn our finished product over to them in perfect condition and at the same time avail ourselves of all of the manufacturing economies that result from such plan of operation.

"These new plants will employ upwards of 15,000 people and will unquestionably tend to improve the industrial conditions of the various centers.

"So you may have an indication of what this tremendous growth and demand for closed cars has been, I might state that with the completion of these additional plants by Jan. 1, it will enable us to meet the demand of upward of 1,000 Chevrolet closed bodies per day."

Ford's New Four-Door Sedan

The Ford Motor Co. is now in limited production of a four-door sedan which will sell at $725 f.o.b. factory. The model is more commodious than the two-door sedan and is designed to meet a particular demand that Ford dealers have been experiencing. The two-door sedan will be continued as the large production vehicle of this type.

A self-contained horizontal press for general work has been placed on the market by the Oilgear Co. It has a capacity of 25 tons at pressing speeds of from one-quarter to 6 in. p. m. The maximum ram speed in the direction of the work is 37 in. p. m. and the maximum return speed 56 in. p. m. The ram speed can be changed instantly by means of a small handle controlling the variable stroke bump. A constant speed two h.p. electric motor drives the pump.

S. A. E. Progress in Standardization Work

The standardization of gasoline railroad cars was discussed at the July truck division meeting in consequence of a suggestion that had been received by the society that a new division of the standards committee be established to work on the standardization of this type of vehicle. It was indicated that the conventional truck chassis will be the basis for the construction of gasoline railroad cars, rather than gasoline powerplant equipment being adapted to typical railroad car construction.

There was a considerable discussion as to whether railroad or automotive engineers should carry on such standardization work, general opinion indicating that the automotive engineers should do so; also that if the work is undertaken, a separate division should be established.

It was suggested at the last truck division meeting that the standardization of mounting dimensions for motor bus bodies be studied, but it was thought that it is too early in the development of this type of vehicle to undertake such standardization.

At the July meeting of the truck division H. B. Knap. of the Packard Motor Car Co., was appointed a subdivision of one to prepare a report on the standardization of motor truck cabs. Tabulated dimensions showing present practice as to cab construction was turned over to Mr. Knap for use in this connection.

In response to demands from the highway authorities of the state of Connecticut, a meeting was held at Detroit on July 24 to discuss the formulation of a "yardstick" of gross carrying capacity and safe operation of motor trucks for administrative use by licensing and law enforcement officials that can be definitely determined by the manufacturer, buyer and the law enforcement official. This meeting was attended by members of the truck division, a representative of the National Automobile Chamber of Commerce and representatives of various truck builders.

It was felt that there is a definite need for a rating and that the essential elements to be considered are the strength and ability of steering gears and of brakes and the strength of the axles. It is considered that these three factors are the important ones in determining the safety ability of a truck on the road and that all are equally important. A subdivision, consisting of A. K. Brumbaugh. chairman; D. C. Fenner and A. J. Scaife, was appointed to submit the suggestions of the meetings to the manufacturers for their consideration and comment.

Motor Truck Output 27 Percent Above Last Year

Reports of the U. S. Department of Commerce record that motor truck production in September, 1922, was 27 percent above September, 1921, though showing an expected decline from summer business. The output for September this year was 18,843, for August this year 24,200 and for September, 1921, 13,648.

Hudson County Auto Show Nov. 11-18

The Hudson County (N. J.) Automobile Trade Association will hold its third annual show Nov. 11 to 18. The display will be held as usual in the Fourth Regiment Armory, Jersey City. The dates mean that the event this year will be open one more day than on the two preceding occasions, the extra session being a Saturday.

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

Dean E. Baskerville, well-known body engineer and designer, has been added to the staff of the Maxwell Motor Corp. Baskerville has been with Dodge Brothers in a similar capacity for the past six years and prior to that time was connected with Packard and a number of body builders. His coming enables E. W. Goodwin, consulting engineer of the Maxwell corporation, to give his entire time to creative work in design.

Lorenz Maisel has been engaged as general works manager for the Allan-Diffenbaugh Tool & Wrench Co., Baraboo, Wis., which has completed plans for a material enlargement of its output to meet the increasing demands of the jobbing trade. Maisel was formerly designing engineer of the Burgess Battery Co. at Madison, Wis., later organizing the Madison Tool & Stamping Co.

R. N. Barnum, vice president of the Mercer Motors Co., Trenton, N. J., has been elected president, succeeding Geo. B. Smith, resigned. W. A. Smith, heretofore second vice president, has been elected first vice president to fill the place of Mr. Barnum. H. D. Fogg, assistant secretary and treasurer, has been advanced to secretary and treasurer.

William H. Frick, has been appointed chief engineer in charge of engineering, development and service departments of the Precision & Thread Grinder Manufacturing Co., Philadelphia. Frick was equipment engineer for the Budd Wheel Co. **D. F. Bruce** has been appointed superintendent in charge of manufacturing and production.

C. E. Wetherald, general superintendent of the motor and axle division of Chevrolet Motor Co., has been made assistant to Charles F. Barth, general manager; William Notman succeeds to Wetherald's former position, and F. O. Tanner, chief inspector of the motor and axle division, becomes superintendent of the gear plant, Detroit.

Carl G. Fisher, founder of Prest-o-Lite and closely identified with the Indianapolis motor speedway, has sold his country home in that city. While he has not discussed his plans for a future home it is known that in recent years he has spent many months each year at Miami, Fla., where he has a residence and a number of interests.

David Fergusson, who resigned some time ago from the Pierce-Arrow Motor Car Co. after being identified with it for more than 20 years as chief engineer, will devote himself to consulting engineering work in connection with high grade motor cars and trucks. He will continue to be located in Buffalo.

B. K. Swartout has resigned as president and director, and **H. H. Lind** has resigned as vice president, treasurer and director of the Ohio Body and Blower Co. **Nathan A. Middleton** has been elected president. The company is expected to devote its entire plant to the making of automobile bodies.

Henry L. Thompson, president Bostwick-Braun Co., Toledo, O., and the William Bingham Co., Cleveland, wholesale hardware dealer and jobber in iron and steel, has been elected chairman of the board of directors and chairman of the executive committee of the Willys-Overland Co., Toledo, O.

Edward J. Connolly has been appointed production manager in charge of the body divisions of the C. R. Wilson Body Co. He has been chief engineer of the factory for the past two years and will continue this work. As production manager he will have entire charge of inspection.

Fred I. Tone has severed his connection with C. H. Wills & Co., Marysville, Mich. Tone has been engineering executive during the development and production of the Wills Sainte Claire car. For several years previous, he was identified with the industry in Indianapolis.

R. C. Durant sailed this month for Honolulu aboard his yacht, the Black Swan, to be absent from this country several weeks. Members of the Durant organization in San Francisco chartered a tug and a band and accompanied the yacht out of the harbor as a farewell.

A. H. Sarver, former president of the Scripps-Booth Corp. of Michigan, has been appointed general manager of the Star Motor Co. of Michigan, which takes over the state distribution of that car. Sarver also is a director of the Durant Motor Co., Inc.

E. E. Hoffman, New York, has been appointed plant engineer at the works of the Hendee Mfg. Co., Springfield, Mass., in charge of the engineering division, with direct supervision of tools and tool design, product design, maintenance and inspection.

George I. McCain, who has for the past year been associated with Colonial Motors, Ltd., of Windsor, Ont., and who has held the office of vice president and chief engineer of this company, has resigned to take up other engineering work.

J. G. Murphy has been made factory manager of the Anderson Motor Co. at Rock Hill, S. C. Murphy was for some time assistant factory superintendent for the Pierce-Arrow Motor Car Co. and superintendent of Kelly Valve Co. of Chicago.

Clarence F. Williams has been elected head of the Simplex Wire Wheel Co., Cadillac, Mich., in place of John P. Wilcox, who resigned on account of the pressure of other business. Wilcox will continue with the company as director.

I. M. Lewis has resigned from the Bessemer Motor Truck Co., effective Nov. 1. Lewis has been president and general manager of the company since its organization 14 years ago. He plans to continue in the motor truck business.

Alfred P. Sloan, Jr., vice president in charge of operations of the General Motors Corp., announces the appointment of William M. Sweet as general manager of the Klaxon Co., with headquarters at Bloomfield, N. J.

Charles W. Wilson has resigned as vice president and general manager of the Willys-Overland Co., Toledo, O., and will return to the Wilson Foundry & Machine Co., Pontiac, Mich., of which he is president.

W. H. Leach of the Buick sales department has resigned his factory position to accept the position of assistant sales manager of the Pence Automobile Co., Buick distributor for Minneapolis and the northwest.

J. W. Wilford has resigned as superintendent of General Motors axle, gear, forge and power plants and will take a two months' vacation, following which he will enter the manufacturing business in Lansing.

John J. Curry has been appointed mechanical superintendent of plant D of the New Departure Manufacturing Co. located at Meriden, Conn. Plant D is the newest unit erected by the company.

H. K. Reinoehl has resigned as chief engineer of the Defiance Motor Truck Co. of Defiance, O., remaining only as a director of that company. He has opened an engineering office.

W. K. Strickland, recently with the General Motors research laboratories, has become affiliated with the Cadillac Motor Car Co. as asssistant chief engineer.

W. K. Swigert, Indianapolis, has been appointed production manager of the Fox Motor Car Co., Philadelphia.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Chevrolet Motor Co., Detroit, has purchased about 29 acres at East Delavan avenue and the Erie railroad, Buffalo, and has plans in progress for new works, with aggregate floor area of 400,000 sq. ft., including machine shop, forge shop, assembling department, testing shop, power house, etc. On the same tract, the Fisher Body Co., Detroit, an affiliated organization, will build a new plant for body manufacture for Chevrolet cars, to total about 200,000 sq. ft. of floor space, for a daily output of 500 bodies. A similar project will be carried out by the two companies at Cincinnati, where property has been acquired in the Norwood section.

General Motors Corp., Detroit, which, as already reported, is establishing an additional passenger car factory for the Chevrolet division in the Samson Tractor Co. works at Janesville, Wis., will also place an additional production unit of the Fisher Body Corp. division at this point. Contracts were awarded Oct. 1 for a new building with 96,000 sq. ft. of floor space, to be equipped for body manufacture and to be ready Jan. 1. An additional building will also be erected for the Chevrolet unit to facilitate final assembling for passenger cars. Retooling of existing Samson buildings for car production is going forward.

Chevrolet Motor Co. has purchased 16 acres in Norwood, O., on which it is proposed to build a plant for the production of Chevrolet cars to supply the southern market. According to W. S. Knudsen, vice president in charge of operations, the Norwood buildings will have 200,000 sq. ft. of floor space for the production of Chevrolet cars, and 150,000 sq. ft. devoted to the production of Fisher bodies. Production will run up to 300 cars daily.

Hupp Motor Car Corp., 3501 E. Milwaukee street, Detroit, has awarded contract to the Everett-Winters Co., Book building, for three four-story and one one-story addition to its plant on Griffin and Moran streets. Two of the four-story plants will cost $500,000, with equipment, and the other, $175,000; the one-story structure will be used in connection with the power house and will cost about $15,000.

Holley Carburetor Co. will complete this month an additiontion to its factory at Detroit, which will about double the output of 1919 when the present factory building was erected and will be the high production record for the company for any one year. The new factory addition will cost $60,000. Much of the equipment which will be installed represents the special design of officials of the company.

Parsons Manufacturing Co., manufacturer of automobile hardware, has opened an office in Chicago in the Mallers building, in charge of C. P. Knisely and W. M. Townsend. The Chicago office will serve the territory of Wisconsin, Illinois, Indiana, St. Louis and Ohio, not including Cleveland and Toledo.

Ford Motor Co., Highland Park, Mich., has commissioned Albert Kahn, 1000 Marquette building, Detroit, architect, to prepare preliminary plans for the erection of its proposed new plant at Hammond, Ind., to be used for assembling work, with initial daily capacity of about 15,000 cars.

Wichita (Tex.) Motors Co. has perfected plans for the consolidation of manufacturing and assembling operations at its local works The branch factory at Oklahoma City, Okla., will be discontinued and the equipment transferred to Wichita Falls, where enlargements will be made.

Wright Roller Bearing Co. plant and property, 20th street and Indiana avenue, Philadelphia, including a two-story factory, 61 x 270 ft., machine tools, power equipment, etc., will be sold on Nov. 9, by the receivers, Harry W. Champion and W. B. Stratton.

Dodge Brothers, Inc., Detroit, is arranging to build with its own construction department, the proposed addition to its automobile works at Hamtramck, Mich., comprising an eight-story building, 200 x 400 ft., estimated to cost $1,000,000, with machinery.

Du Pont Motors, Inc., Wilmington, Del., manufacturer of high-speed automobiles, is concluding negotiations for property on Vandever avenue, for local works. The structure will be improved and the plant at Moore, Pa., removed to this location.

Ford Motor Co., Lincoln Highway, Kearny, Newark, N. J., will build a new one-story power house, 53 x 160 ft., at its local assembling plant. A gasoline storage building will also be erected. The expansion will cost in excess of $180,000.

Central Products Co. and the **Central Gear Co.,** Detroit, of the inter-company parts group of General Motors Corp. have been taken over by the Chevrolet Motor Co. and will be operated as units of that company, manufacturing parts.

Six-Wheel Truck Co., Fox Lake, Wis., contemplates engaging in commercial production of its new design of six-wheel motor truck and will build a factory, about 40 x 100 ft., during the winter. F. N. Pettigrew is president.

General Piston Ring Co. is the new name for the company heretofore known as the Teetor Mfg. Co., Indianapolis This is a change in name only. There is no change in ownership, management, business policy or product.

Maxwell Motor Corp., Oakland avenue, Detroit, has awarded a contract to the H. K. Ferguson Co., 6523 Euclid avenue, Cleveland, for a one-story addition, 80 x 440 ft., estimated to cost $100,000, including equipment.

Ternstedt Mfg. Co., Artillery and Muster streets, Detroit, manufacturer of automobile hardware, has filed plans for a new one-story addition on Artillery street, estimated to cost approximately $235,000, with equipment.

Harrison Radiator Co., Washburn street, Lockport, N. Y., manufacturer of automobile radiators, has plans in preparation for the erection of a three-story addition, 150 x 300 ft., at Washburn and South streets.

Detroit Air Cooled Car Co. will occupy the former plant of the Harron Motor Co., Wayne, Mich., for the production of its D-A-C car. A building, 70 x 250 ft., is being equipped. W. J. Doughty is president.

White Motor Co., Nashville, Tenn., Howard C. Goss, general manager, has tentative plans for new works at Chattanooga, Tenn., to manufacture motor trucks and parts. A site is being selected.

Chevrolet Motor Co., Detroit, is completing plans for a new two-story assembling plant, 145 x 685 ft., on Hillside avenue, Oakland, Cal., estimated to cost in excess of $500,000, including machinery.

Mercury Mfg. Co., manufacturer of storage battery trucks and automobile trucks, 4118 South Halsted street, Chicago, has let contract for a one-story addition, 60 x 100 ft., to cost $12,000.

Studebaker Corp., South Bend, Ind., has completed plans for the erection of a new one-story addition to its power plant on Tuttle street, estimated to cost about $125,000.

Detroit Steam Motors Corp., Windsor, Ont., is building a plant to cost $200,000 and will shortly be in the market for machinery and tools.

Baker R & L Co., Cleveland, plans the erection of a factory extension at an expenditure of $10,000.

Body Builders

Mengel Body Co., a $600,000 concern, according to an announcement by the Louisville Industrial Foundation, will be organized and occupy a 30-acre site at 4th and G streets in that city. The new plant will manufacture bodies for light trucks, park and station wagons and regular chassis. The plant will consist of woodworking shops, dry kilns and assembling, painting and finishing departments, containing 200,000 sq. ft. of floor space. It will be so arranged that additional units may be added. Plans for the new company were agreed on by R. Frank Monroe of Ludington, Mich.; W. C. Durant, Detroit motor manufacturer, and William L. Hoge and Arthur D. Allen of the Mengel Co. Mr. Allen will be president of the company, and Mr. Monroe and Mr. Hoge, vice presidents. Mr. Monroe soon will remove to Louisville.

Mahlow & Wycoff, Brunswick avenue and the East Trenton railway, Trenton, N. J., machinists, have tentative plans for expansion for the manufacture of special coal-delivery bodies for Ford automobiles. The light-weight steel dump body now being produced in one size will be developed in a number of larger sizes, with power hoists, for use on other type car chassis.

Durant will build bodies for the Durant four and the Star for the eastern territory in the Elizabeth plant. The company states that 3,000 of these bodies will be built there during the month of October so as to be ready for assembly work on Nov. 1. At the present time there are 165 men on the Elizabeth payroll, but it is hoped to increase this to 3,000 by March 1.

Holbrook Co., automobile body manufacturer, Hudson, N. Y., has awarded contract for a manufacturing building 100 x 260 ft., boiler house 20 x 30 ft., service building 20 x 30 ft., and connecting passage 25 x 50 ft. Estimated cost $80,000. One 100 h.p. boiler with 100 ft. radial brick stack and complete sprinkler system with 40,000 gal. steel gravity tank are included.

Martin-Parry Corp., York, Pa., manufacturer of automobile bodies, is arranging for the immediate occupancy of its new plant at Flint, Mich., comprising a remodeled warehouse formerly used by the Dort Motor Co. Initial production at the works will be devoted to truck bodies for the Durant Motor Co.

F. W. Phillips and associates of Cleveland have closed a contract with the Ravenna, O., Chamber of Commerce to locate an automobile body plant in that city. The plans provide for the completion and equipping of the buildings of the McElrath Tire & Rubber Co. for use as a body plant.

Universal Body Corp., 230 E. Ohio street, Chicago, capital $50,000, has been incorporated by A. H. Earl, J. L. Geier, H. L. Schroeder, to manufacture and deal in auto bodies vehicle accessories, etc. Correspondent: Coburn, Kearney & Coburn, 58, 106 N. LaSalle street.

Springfield Commercial Body Co., Inc., has been formed in Springfield, Mass., to manufacture, repair and deal in automobile bodies. Charles B. Ring is president and L. Philip Smith is treasurer of the concern, which has an authorized capitalization of $200,000.

Fisher-Ohio Body Corp., General Motors building, Detroit, manufacturer of automobile bodies, has awarded a contract for the erection of a new two-story plant on Wilcox street, Flint, 200 x 400 ft., to be equipped for assembling.

J. J. Walsh Co., 1540 Columbus avenue, Roxbury, Boston, manufacturer of automobile bodies, is taking bids for two-story addition, 50 x 100 ft., estimated to cost close to $30,000. S. J. Rantin, 1117 Columbus avenue, is architect.

Briggs Mfg. Co., Hamtramck, Mich., has plans under way for the erection of a new one-story power plant at its works, 80 x 83 ft. The company specializes in the manufacture of automobile bodies. M. L. Briggs is secretary.

Commercial Auto Body Co., 2540 South Wabash avenue, Chicago, has leased the three-story and basement factory at 3548-58 Shields avenue, for the manufacture of truck and delivery bodies.

T. D. Whiteborn, of Atlanta, Tex., plans to establish at Sweetwater, Tex., a factory for the manufacture of truck bodies. The plant will be opened October 16, according to Whiteborn's plans.

Edward G. Budd Mfg. Co., 25th street and Hunting Park avenue, Philadelphia, manufacturer of steel automobile bodies, is completing plans for the erection of a large plant addition.

American Top Co., Indianapolis, capital $5,000, has been organized to manufacture tops, seat covers, etc. Directors, John T. Morrison, John O. Schuelke, P. M. Schuelke.

Van Auken Body Co., Pontiac, Mich., has enlargements under way for considerable increase in production. C. M. Van Auken is secretary and treasurer.

Lansing (Mich.) Bus Co., manufacturer of automobile bodies, has purchased the plant of the Ideal Engine Co. for branch works.

Wood Hydraulic Hoist & Body Co., 1025 Tecumseh road, Windsor, Ont., will build an addition to cost $10,000.

Fremont (O.) Metal Body Co. has placed contract for a factory, 60 x 245 ft.

Packard to Celebrate Anniversary

The Packard Motor Car Co. is preparing to celebrate the 23rd anniversary of the production of its first automobile. The first Packard was completed at Warren, O., by J. W. Packard, Nov. 6, 1899. It had a one-cylinder motor with a belt drive and three speeds forward and reverse through sliding the belt. The Packard factory was moved to Detroit from Warren in the fall of 1903.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, of THE AUTOMOTIVE MANUFACTURER, published monthly at New York, N. Y., for Oct. 1, 1922.

State of New York,
County of New York, ss.

Before me, a Notary Public in and for the state and county aforesaid, personally appeared G. A. Tanner, who, having been duly sworn according to law, deposes and says that he is the Business Manager of The Automotive Manufacturer, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:
Publisher: Trade News Publishing Co., 153 Waverly Place, New York City.
Editor: Morris A. Hall, 153 Waverly Place, New York City.
Managing Editor: Morris A. Hall, 153 Waverly Place, New York City.
Business Manager: G. A. Tanner, 153 Waverly Place, New York City.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)
Trade News Publishing Co., 153 Waverly Place, New York City.
G A. Tanner, 153 Waverly Place, New York City.
Paul Morse Richards, 153 Waverly Place, New York City.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

G. A. TANNER, Business Manager.

Sworn to and subscribed before me this 5th day of October, 1922.
(SEAL) JOSEPH R. FRITH,
Notary Public, Kings County, No. 114.
Certificate Filed in New York County No. 260.
Kings County Register's No. 4116.
New York County Register's No. 4231.
Commission Expires March 30, 1924.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

3307—A merchant in Italy desires to secure an agency for the sale of imitation or artificial leather for automobiles and furniture. Correspondence, French or Italian.

3318—A commercial agent in Italy desires to secure an agency for the sale of automobile accessories. Correspondence, French or Italian.

3323—A mercantile firm in Bangalore, India, desires to purchase and secure an agency for bicycles, motorcycles, etc. Quotations, c.i.f. Indian port. Terms, cash against documents.

3401—Fuel oil, paraffin oil, and lubricating oil—Denmark. Agency desired for an American company.

3408—Motorcycles and side cars—Czechoslovakia. The purchase is desired by a buying agent in the United States. Quotations, f.o.b. New York. Payment to be made in New York against documents.

3445—Machine for sewing automobile tires—Mexico. Quotations, f.o.b. place of shipment. Payment, cash. Correspondence, Spanish.

3449—Hardware, textiles, machinery, automobiles, etc.—Argentina. Purchase and agency desired from manufacturers.

3464—Hardware in general, machinery, automobiles, trucks and accessories, office supplies, novelties, and provisions—Cuba. Commission agency and general representation desired. Quotations, c.i.f. Cienfuegos. Correspondence, Spanish.

3507—Automobiles and accessories, motorcycles, and sporting goods—Spain. Purchase and agency desired. Quotations, c.i.f. Corunna or Vigo. Correspondence, Spanish.

3511—American white-oak planks of various lengths, thicknesses, and widths as used for building and repairing railway wagons of all descriptions—Wales, Purchase of goods and agency desired. Quotations, c.i.f. Cardiff, Newport Barry, Port Talbot, and Swansea.

3551—Automobiles—Greece. Agency desired for small car by a manufacturers' agent who has an automobile service station equipped to handle all kinds of repairs.

3560—Lubricating oils for automobiles and industrial machinery—Spain. Agency desired. Quotations, c.i.f. Barcelona. Terms, payment against delivery of shipping documents.

3564—Automobile supplies in general, jacks to lift from 1 to 5 tons, and spanners and wrenches of all kinds—England. Purchase or agency desired. Quotations, c.i.f. London.

3568—Automobiles, tires, and automobile accessories—Spain. Representation desired. Correspondence, Spanish.

3583—Automobiles and bicycles—Spain. Purchase desired. Quotations, c.i.f. Malaga. Terms, payment against documents. Correspondence, Spanish.

3609—Automobiles and trucks, tires and other accessories —Spain. Purchase is desired. Quotations, f.o.b. New York. Correspondence, Spanish.

3617—Motor trucks, agricultural implements, belting, hardware, tools, plumbing supplies, cook stoves, sanitary supplies, and automobile accessories—Palestine. Purchase is desired. Quotations, c.i.f. Jaffa.

3619—Iron, steel, and metal, rolled iron and metals, iron and metal sheets and tubes, railway carriage wheels, steel hardware, and automobiles—Hungary. Agency desired. Quotations, c.i.f. Budapest if possible, or Hamburg.

3620—Marine motors, automobiles and accessories, and gas oil for motors—Spain. Agency desired. Quotations, c.i.f. Corunna.

3621—Veneer polish for cleaning and polishing automobiles, with special spray for applying—England. Purchase desired. Quotations, c.i.f. Liverpool.

3632—Automobile tires and automobile accessories—South Africa. Purchase desired. Quotations, f.o.b. New York.

3636—Automobile accessories—Canary Islands. Representation of export houses desired. Quotations c.i.f. Santa Cruz. Terms, cash against documents.

3668—Automobiles and accessories—Sweden. Purchase and agencies desired. Quotations, c.i.f. Goteborg or f.o.b. New York. Terms, payment against documents or by letter of credit in New York.

3704—Bicycles and bicycle accessories, including tires—China. Purchase desired. Quotations, c.i.f. Antung. Catalogues and prices are requested. Terms, cash.

3711—Thermostatic regulators—Canada. Purchase desired. Quotations, f.o.b. shipping point. Payment, cash.

3736—Artificial leather—South Africa. Agency desired.

3792—Automobiles and tractors—Mexico. Purchase desired. Correspondence, Spanish.

3794—Motor cars of the $400 class—Switzerland. Agency desired. Quotations, f.o.b. Geneva.

3918—Solid and cushion carriage tires and carriage mats—Canada. Agency desired.

3807—Vanadium steel, rollers and ball bearings, gasoline feeders, speedometers for automobiles and motor cycles, brake bands, and lubricating oils—Italy. Purchase and agency desired. Quotations, c.i.f. Genoa preferably.

3867—Small steam automobile—Denmark. Agency desired.

3837—Motor cars and accessories of medium quality—France. Agency desired. Quotations, c.i.f. French Port. Correspondence, French or Spanish.

3891—A low-priced motor car and automobile novelties

3993—Automobiles and motor cycles—Italy. Agency desired. Correspondence, Italian.

and accessories—Norway. Agency desired.

4010—Motor fire-fighting apparatus and supplementary fire-fighting equipment—India. Purchase desired. Quotations, c.i.f. Karachi. Terms, cash upon delivery. Illustrations and price lists are requested.

4039—Trucks, especially those suitable for passenger transportation, and trailers, motorcycles, bicycles, and disk wheels—South Africa. Agencies desired. Payment to be arranged by letter of credit or through commission houses in New York.

The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1, Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3, Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

The Automotive Manufacturer

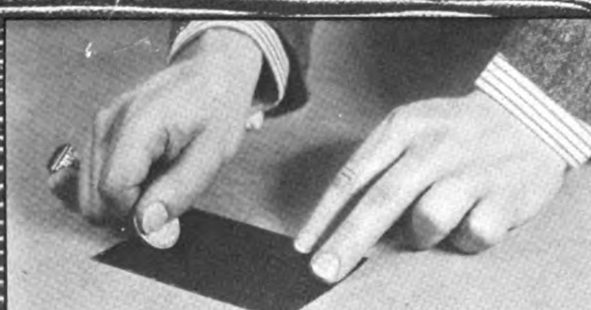
The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. LXIV. No. 8 NOVEMBER, 1922 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N Y., under the Act of March 3.


MARMON



The Automotive Manufacturer

A Consolidation of The Hub and Automotive Engineering

Vol. LXIV. NEW YORK, NOVEMBER, 1922 No. 8

Research on Small Drilled Orifices

BY W. S. von Bernuth, Ph.B., Member A. S. S. E.*

With Special Reference to the Extremely Small Holes Needed in Carburetors and Vaporizing Devices—Special Apparatus Designed for the Testing.

MANY carburetion devices, as well as other instruments embodying small orifices are difficult to design intelligently because too little fundamental data are available. This necessitates development work on any device of this character for the particular work in progress.

When applied to carburetors it is found that the same bore orifice would change the metering characteristics, depending on temperature of the fuel, the design of the orifice with respect to its length of bore, area of approach, discharge, and various other factors.

As a part of the extensive research conducted by the Purdue Engineering Experiment Station on carburetion and combustion the effect of these various factors were studied.

A portion of the apparatus used was originally designed by Prof. O. C Berry, formerly in charge of automotive engineering, for use in undergraduate thesis work. The plant was entirely redesigned and improved to allow accurate determination of the data sought after. The plant was designed by C. S. Kegerreis and J. W. Geiger, the latter making the actual testing on the plant.

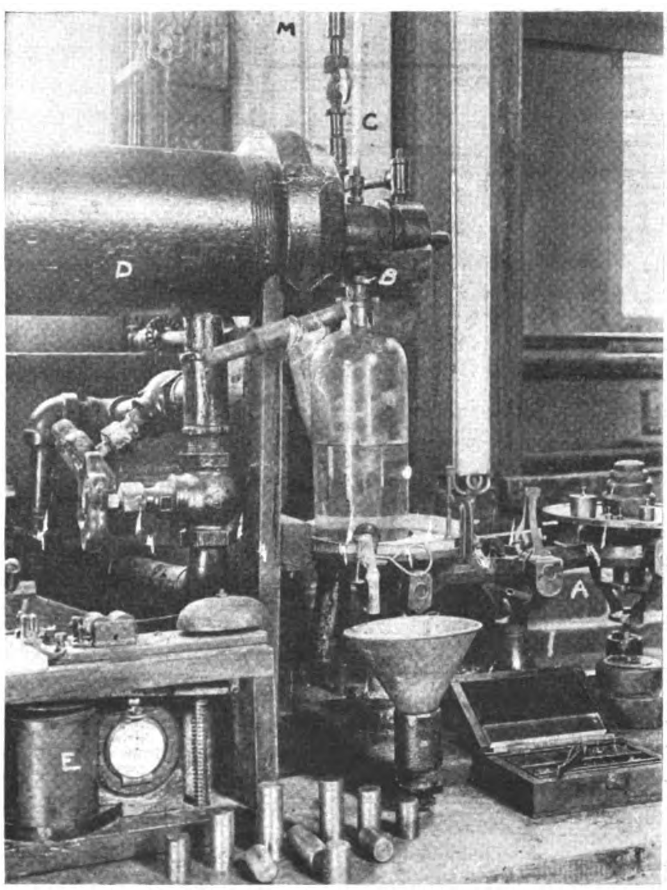


Fig. 1. Detail of measuring instruments used in measuring the flow of fluids.

The plant is shown clearly in the accompanying plates, Figs. 1, 2 and 3. Fig. 1 shows the measuring instruments used in determining the flow of the fluids. Fig. 2 presents a view of the measuring devices as well as the controls for temperature and pressure changes. The entire plant is pictured in Fig. 3 which gives in addition the apparatus for providing a change in temperature.

In more detail, Fig. 3, D, represents the temperature drum in which a pipe coil is arranged to carry the fluid to the metering orifice. The control of the drum or jacket is so arranged as to provide either steam or hot water for the higher temperatures and brine solution for the lower temperatures. The gas water heater is shown by J, and the brine tank I is connected with a pump driven by the electric motor L. This arrangement allows both thermal syphon and forced circulation and either can be used for accurate control of the drum temperatures.

The fluid studied is supplied from a tank without the building, K, Fig. 3, and is conducted to the float chamber H, where a constant level is maintained. From the float chambe the liquid is conducted t

* Personnel Assistant to Dean of Engineering, Purdue University, where the tests were conducted.

the coil in chamber D, where the temperature is maintained to suit any particular condition.

In order to provide higher heads on the orifice air pressure was used. The air was free from moisture, being

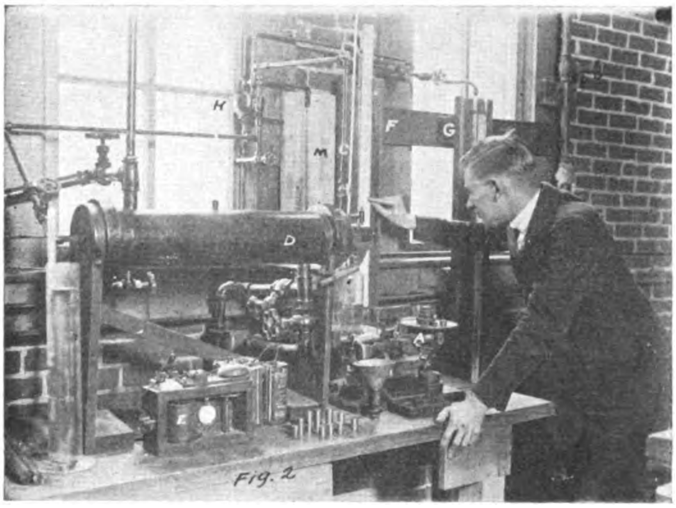


Fig. 2. General view of measuring devices as well as control instruments for temperature and pressure.

passed through suitable separators and tanks. The air pressure was placed on the fuel in the supply tank and on the float chamber, thus the control of the head on the fuel was readily obtained. Manometers F and G, Fig. 2, read the air pressure head and the gage M the static fuel head. The temperature is read to a tenth of a degree by a thermometer at C.

The discharge from the nozzle B, Fig. 1, is caught in an aspirating bottle placed on a sensitive balance. The aspirating bottle was used to allow very little evaporation from the liquid and to allow an easy means of disposing of the liquid after testing. The balance is so arranged that as the beam comes to a balance an electrical circuit is closed with operates a stop watch by means of an electro-magnet. The discharge with respect to time can thus be very accurately attained.

At the present time data is available on 56.5 Be' gasoline, 41.2 Be' kerosene and distilled water. As time permits the tests will be supplemented by additional research on some of the points not understood at the present time. The investigation when completed will show the effect of:

1. Temperature.
2. Pressure.
3. Type of fuel.

on any one orifice and the flow as affected by:

4. Orifice diameter.
5. Orifice plate thickness.
6. Area of approach and discharge.

The accompanying graph, Fig. 4, presents a few of the results obtained. One plot shows the effect of temperature on this individual orifice and the other, the actual discharge in pounds gasoline per unit of time.

When the results warrant publication a bulletin will be prepared and published by the Engineering Experiment Station.

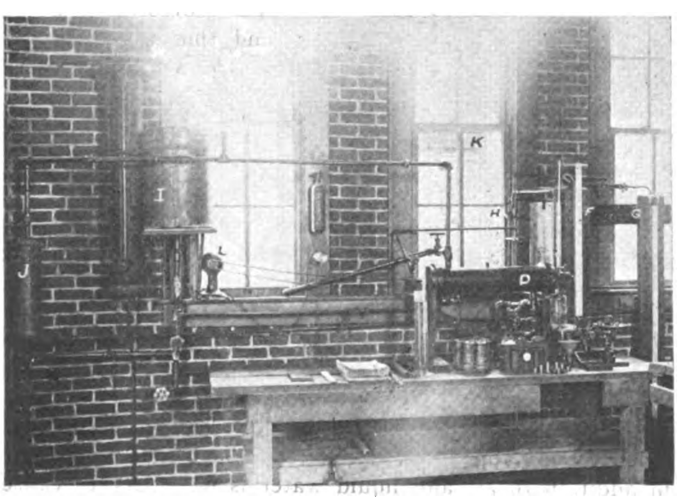


Fig. 3. More general view of the entire testing outfit, emphasizing its marked simplicity.

Coming National Auto Shows to Be Bigger Than Ever

With 85 different makes of automobiles and 290 accessory manufacturers listed as exhibitors, the National automobile shows of New York and Chicago will be the biggest automobile exhibitions ever presented in this country.

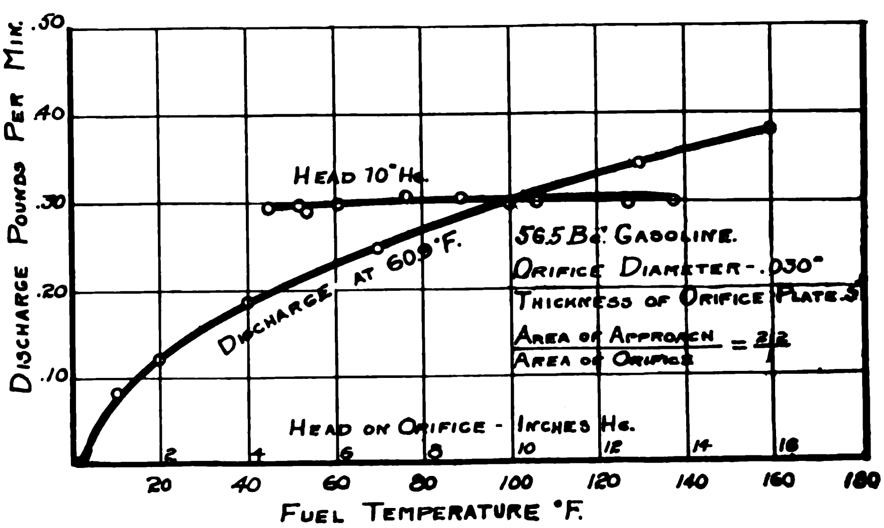


Fig. 4. Chart showing plotted results. A ctual discharge and effect of temperature on orifice discharge.

The New York show will be held Jan. 6 to 13, while the Chicago Exposition in the Coliseum and 1st Regiment Armory will be held Jan. 27 to Feb. 3. Both displays are under the direction of the National Automobile Chamber of Commerce. The Grand Central Palace will again house the New York show in its entirety. For the show, the four floors of the Palace that will be occupied contain 200,000 sq. ft. of space, as each floor is equal to a city square block in area. For the most part, the cars will occupy the two lower floors, but it has been found necessary, because of the great demand for space, to put several of the cars on the third floor.

It is a little early to divulge what this season's show will bring forth, but a number of innovations are bound to be presented.

S. A. Miles, general manager of the national shows recently returned to the city and is now actively engaged in the promotion of the exhibition.

Effects of Steel Corrosion on Motor Car Bodies

BY PROF. C. O. BANNISTER, A. R. S. M., F. I. C.*

Theory of Corrosion, Results of Steel Plates and the Effects of This Upon the Finished Motor Vehicle Body—How it Can be Avoided.

CORROSION and decay of metals is of universal importance, and is a subject which presents considerable difficulties to the investigator owing to the large number of factors which have to be taken into account, and the extreme complexity of the reactions which may take place during its progress. To the members of this institute the subject is of special importance owing to the fact that there is an insidious form of corrosion which is of great trouble to bodybuilders, and appears in the panels and wings of cars even after extreme care has been taken to eliminate all known causes of corrosion, and every precaution has been taken to prevent the possibility of conditions favorable to corrosion. This particular type of corrosion makes itself manifest in the first place by the appearance of blisters in the paint coatings, which are first quite small in extent, but which, when once started, appear to increase rapidly. In some cases these blisters first appear shortly after the parts are finished, but in other cases do not make their appearance until weeks or months have elapsed after the car is finished. In extreme cases the paint actually peels off the part affected. Your council has given considerable attention to this subject, but up to the present no absolutely safe method of work in the manufacture of the parts chiefly affected has been evolved. The object of this paper is not to pretend to offer a solution to the problem, but rather to call attention to the modern views on the cause and prevention of corrosion, and to encourage discussion among practical men, which may lead to the correct method of eliminating the trouble.

Theories of Corrosion

There are three main theories of the cause of corrosion which are not necessarily antagonistic, and each one of which appears to have some bearing on the particular type of corrosion under consideration. These theories are the acid theory, the electrolytic theory and the colloidal theory.

The acid theory summarized by Calvert in 1871, assumes that the presence of some acid body is necessary in order that corrosion may commence, and that then reactions take place according to simple chemical laws. In support of this theory we have the well-known fact that water, from which all traces of impurity have been removed, has no corrosive action on iron or steel; also that dilute mineral acids rapidly corrode and dissolve iron, and that ordinary corrosion is accelerated by the presence of carbon dioxide in water. The importance of this theory will be evident later during the discussion of the effects of pickling steel sheets to be used for panels, etc., and on the realization of the great difficulty of eliminating every trace of acid after the pickling operation.

The electrolytic theory assumes that corrosion is due to electrolytic action caused by difference of potential between the various constituents of the metal and the corroding medium, and the consequent formation of electric currents. All forms of corrosion may be considered to be electrolytic in character, and as corrosion never occurs in the absence of moisture it becomes a problem of solution. It is a well known fact that metals of a high degree of chemical purity are less readily attacked by dilute acids than impure metals, and quantitative experiments on the velocity of solution of metals indicate that the process is invariably dependent on the formation of local circuits. In ordinary commercial metals the distribution of small quantities of impurities throughout the mass as, for example, in the case of mild steel, the presence of small particles of carbide and phosphide of iron, sulphide of manganese, etc., increases the number of local couples and hence also the velocity of attack. As pointed out above, the presence of water is necessary as iron does not rust in dry steam, even when carbon dioxide is also present. An acid or some other electrolyte is also necessary for corrosion, as iron exposed to pure water and oxygen does not rust. It is found that differences in potential of the same metal may be caused by different conditions of strain, for example, the electrolytic potential of a portion of metal strained by cold working, etc., is different from that of an unstrained or annealed portion. These differences in state may be sufficient to provide the local couples necessary for corrosion.

The colloidal theory enunciated by Dr. Friend in 1921, assumes that, on coming into contact with air and liquid water, iron is slowly oxidized to ferrous hydroxide which is produced in the colloidal condition, a state in which it is usual for many substances to be extremely chemically reactive. The colloidal ferrous hydroxide oxidizes in the air to a higher hydroxide, still in the colloidal form, and under favorable circumstances this higher oxide will be ferric hydroxide.

This higher colloidal hydroxide now acts catalytically, accelerating the oxidation of the iron and, simultaneously undergoing to a lower colloidal hydroxide, only to be oxidized again as oxygen from some source diffuses towards it; when the colloid precipitates out, rust is produced. For the comparison of the value of these three theories it may be repeated here that all forms of corrosion are undoubtedly electrolytic in nature, and the same remark probably applies to all forms of chemical activity.

In the first theory mentioned above, the chief importance is attached to the corroding solution or "electrolyte," and no importance is attached to the conditions of the metal itself, which may favor electrolytic action and hence corrosion. Its chief value is found in the fact that it emphasizes the necessity of something in addition to water, which, in the perfectly pure state, is a non-conductor of electricity, that is, the presence of an electrolyte.

The second theory mentioned is probably sufficient to explain all classes of corrosion, but as usually studied, places too much importance on the condition of the metal, and too little on the necessity of an electrolyte. The third theory appears to neglect the fact that something in addition to air and liquid water is necessary to cause corrosion, that is, to convert the water into an electrolyte

* Liverpool Univ., paper read before the British Carriage & Automobile Manufacturers' annual conference at Liverpool, Eng., September, 1922.

and also overlooks the electrochemical activity of the hydroxides of iron.

Influence of Reaction on Paint Coat

The nature of the reactions taking place during corrosion, as stated in this theory, are undoubtedly of value in explaining the progress of corrosion as it takes place under a more or less perfect coat of paint. There are two distinct forms of corrosion recognized, viz., "general corrosion" and "pitting." In "general corrosion" there is a more or less uniform removal of metal from the surface, and this form is much less serious than "pitting," which results from localized action, and may proceed until perforation occurs in the case of sheets and plates of metal long before the bulk of the surface of metal is seriously affected.

This localized form of corrosion is greatly assisted by the presence of minute traces of foreign matter in the steel, and in cold-worked metal any inequalities in the degree of deformation also tend to encourage localized corrosion, for example, the severely cold-worked metal surrounding a punched hole in a sheet is always the area at which corrosion commences if opportunity offers. The rate at which corrosion proceeds after it has once started largely depends on the character of the products of the corrosive action itself. In certain cases the product formed during corrosion is a hard impervious layer of hydroxide of the metal, so firmly adherent to the metal that it acts as a protector. This is the case with the metals zinc and aluminum, which are readily acted on by moist air, and the original bright surfaces soon become dull through the formation of a layer of hydroxide, and under ordinary conditions the action is arrested at this point.

In other cases, such as irons and steel, the product formed, hydroxide of iron or rust appears as a loose flocculent precipitate which is porous, and does not act as a protector to the metal, but rather accelerates the corrosion partly by its capability of retaining liquid, and partly by its own chemical activity. It may be useful here to consider the processes commonly used for the protection of iron and steel from rust. Painting consists of the application of adherent protective films of material impervious to moisture and air in order to prevent the access of these to the metal. In addition to this, painting is carried out to give a good appearance and finish to the article painted. Electroplating, which is largely used in the manufacture of motor car fittings, etc., consists in the deposition by electrical means of a thin film of coating of a more expensive and less corrodible metal, e.g., nickel or silver on to an article made of a metal cheaper and more suitable for working than the deposited metal.

This process is used with a double object in view, namely, to reduce or prevent atmospheric attack, and give a good appearance. The process of galvanizing is commonly used on a large scale to protect sheet iron, etc., from corrosion, and this consists in coating the iron or steel used with zinc. Metallic zinc is not very readily corroded, and when the metal is attacked and oxidized the film formed is close and adherent, and tends to protect the metal from further action. Should, however, the surface of zinc be imperfect to commence with, or should perforation of the zinc occur by corrosion a zinc-iron couple is immediately formed, which is helpful to electrolytic corrosion. In this case, however, the zinc becomes the anode, and tends to pass into solution, the iron or steel acting as the cathode, and thus being protected from corrosion as long as any zinc exists in its neighborhood.

A coating of metallic tin is another method commonly used for the protection of iron and steel, a very thin coating of the metal being used in the manufacture of tin plate. Tin is similar to zinc in being little affected by atmospheric conditions, dilute acids, etc., but should the coating be imperfect, or should perforation occur, then an iron-tin couple is produced, the iron being the anode and the tin the cathode, so that under favorable conditions corrosion of the iron proceeds more rapidly locally than it would have done in the absence of tin. The coating of iron and steel with a thin film of oxide of iron, similar in composition to hammer scale has been used as a method of protection, and is good as long as the film or coating is complete. This oxide coating is produced by heating the metal in air or steam. When the coating is formed in which the iron acts as the anode as in the case of tin plate, and so corrosion is actually hastened.

Corrosion Effects on Motor Bodies

To return to the problem under consideration, the corrosion of steel as used in motor car bodies, the subject may be dealt with in the following order:

(1) The metal used.

(2) The treatment of the metal before receipt by the motor body builder.

(3) The subsequent treatment of the metal.

1. The Metal Used. This generally consists of mild steel plate commonly obtained as cold rolled, close annealed, and in this condition should be easily worked up into shape. This material should undoubtedly be of high class quality, and from what has already been said on the electrolytic theory of corrosion it will be evident that the lower amount of impurities, especially sulphur and phosphorus and slag inclusions, which may be microscopical in size, the more capable of resisting corrosion will the metal be.

Of far greater importance than the actual amount of the ordinary impurities of steel, however, is the possibility of the presence of oxide of iron in the metal, as investigation has shown that this greatly increases the liability to corrosion. The oxide may be present in steel of otherwise correct composition, and is generally associated with wild heats. During the casting of these wild heats the metal is found to split and fly considerably. It would be well, in drawing up specifications for steel sheets for motor car purposes, to include a clause to the effect that ingots of wild or overoxidized steel must not be used. To obtain metal more resistant to corrosion than ordinary mild steel sheets, two methods are open for adoption, viz.:

(a) To refine the metal as far as possible towards perfectly pure iron.

(a) Iron approaching chemical purity may be obtained by the electrolysis of suitable solutions or by a special modification of the open hearth process.

Iron has been obtained by the electrolytic process of the following composition:

Carbon	0.013
Silicon	0.002
Sulphur	0.001
Manganese	Nil
Phosphorus	0.010

which is evidently of a high order of purity, but at the present time this cannot be considered economically ap-

plicable for motor bodies and similar purposes, although developments will undoubtedly be made in this direction in the course of a few years.

(b) By the furnace method extremely pure iron is made and is put on the market as Armco iron; the following is a typical analysis of this material:

Carbon	0.012
Silicon	Trace
Sulphur	0.025
Phosphorus	0.004
Manganese	0.019

The metal obtained by both these processes is capable of resisting corrosion to a high degree, but as a result of their extreme purity will be comparatively soft and flexible. It would be necessary to submit them to fairly severe cold work in order to obtain the necessary rigidity for wings, etc.

Some Constituents Reduce Corrosion

It has been found as the result of years of experiment that the addition of certain metals to steel greatly increases its resistance to corrosion, and this is particularly so in the case of the addition of the metal chromium. Stainless steel is now a commodity of every day use, and consists of an alloy steel containing from 12 to 14 percent of chromium. When properly made and prepared it is not only resistant to ordinary atmospheric oxidation and corrosion, but also resists in a remarkable way the action of many inorganic and organic acids, etc.

As generally known "stainless steel" is unsuitable for motor body builders on account of its high price and certain properties which render it difficult to work. The latter difficulty is now being overcome by the production of an alloy of iron and chromium very low in carbon, say under 0.1 percent, as compared with about 0.5 percent usually present in stainless steel. This material is known as "stainless iron," and although the cost of rolled sheet is probably prohibitive for motor body building at the present time there are bound to be developments in the method of manufacture in the near future which should reduce its price considerably. The addition of metals other than chromium to iron and steel is found to increase the resistance to corrosion, for instance, small quanitties of copper have been found to be beneficial, steel with no copper. Other investigations have shown that small quantities of copper, nickel or cobalt, varying from 0.25 to 3 percent in steel considerably increase its resistance to corrosion.

2. The treatment of the metal before receipt by the motor body builder, that is, in the processes used in its manufacture, may have considerable effect on its subsequent resistance to corrosion. During the heating of the metal for the rolling operations oxide of iron forms on the surface; this oxide is commonly known as hammer-scale, because it scales off the metal in the form of thin plates during hammering and rolling. It has already been pointed out that the presence of a discontinuous surface of this oxide is particularly objectionable under conditions favorable to corrosion because it causes the formation of a couple in which the iron, acting as the anode, tends to pass into solution, and thus becomes corroded away. In the preparation of sheet steel for special purposes it is usual to remove this scale by an operation of "pickling," which consists in dipping the sheets into an acid bath. The acid attacks the surface of the metal, and this action causes the removal of the scale.

There is a definite danger attendant on this "pickling" operation in that the last traces of acid are extremely difficult to remove from the metal. The metal appears to be porous to the acid, and tenaciously retains minute quantities even after drastic washing operations. The retention of even minute traces of acid will inevitably lead to corrosion, and the conditions set up by this retention would appear to be exactly those favorable to the type of corrosion under discussion. After "pickling" and thorough washing the sheets should be close annealed; that is annealed under conditions which prevent serious oxidation of the surface. During this annealing the temperature should be such that all traces of acid are driven off and all traces of basic salts are decomposed. After pickling, the sheets should be cold rolled to improve the surface, and to slightly increase the hardness and elasticity of the metal. During transit from the steel manufacturer to the motor-car builder the sheets must be protected from corroding influences by an application of a suitable grease and careful packing.

Precautions Needed in Working Metals

3. The subsequent treatment of the steel by the motor body builder, that is the shaping, painting, etc., for the production of the finished article involves several operations, during which precautions must be taken to avoid the possibility of the commencement of corrosion. The cold work put on the metal during shaping operations will cause distortion of the crystals and different stresses in different parts of the sheet, and it has been already pointed out that these differences are sufficient to cause differences in potential when submitted to the action of an electrolyte, with resulting increase to susceptibility to corrosion. In order to remove these stresses an annealing operation is necessary, but if this be resorted to care must be taken to avoid the formation of scale, and it must also be remembered that the annealed article may prove to be too soft and flexible for the work in hand. When joining is necessary, as in the case of wings, oxy-acetylene welding of the part, using a Swedish iron feeding rod and no flux will be found to be most suitable. The use of brazing with fluxes is objectionable, as it is extremely difficult to get rid of the last traces of flux used, and these traces in the presence of moisture form an electrolyte which is favorable to corrosion. It is a noteworthy fact that when corrosion is found in wings, etc., which contain a joint welded by the oxy-acetylene blowpipe, the corrosive action seldom appears near the weld itself, probably owing to the annealing action of the flame on the metal in the vicinity of the weld. After the shaping of the article, and previous to the application of paint, it should be thoroughly cleaned, preferably of means by sand blasting or sand papering for the removal of all traces of extraneous matter.

Any trace of rust in the sheet should be soaked with benzine, and then burnt out with a blowpipe flame. All traces of grease must be removed, preferably by burning off. In connection with the application of various coats of paint it is interesting to note that there is no virtue in the number of coats applied, but that the efficiency depends on the nature of the various coats, and to some extent on the nature of the surface to which the paint is applied; if the surface be too smooth and highly polished there will be insufficient grip between the metal and the films of paint. There is some discrepancy as to the effect of multiple coats of paint applied; the results of experi-

ments conducted in Germany some years ago indicating that with an increase in the number of coats of paint corrosion actually increased, whereas certain results of Dr. Friend indicate that the opposite is the rule. These experiments, however, were conducted on a small number of coats of paint only, this varying from 1 to 3. The priming or first coat of paint applied to the steel is by far the most important, and the best priming consists of red lead with linseed oil, which should be allowed to dry thoroughly before subsequent coats are applied.

Discussion was invited by the president, who said they would agree that they had had a scientific lifting of the screen which veiled the unknown. They were deeply indebted to the professor for what they had heard, and it was the first time they had had the subject so well put before them by one who was an au fait with the particular subject, and there had been put before them many points of wonder and difficulty which had not occurred to them before.

Iron Not so Suitable for Motor Vehicles

S. Norris, in proposing a vote of thanks to Professor Bannister for his able and useful paper, said that as a practical coachbuilder, though not a scientific man in any way, there was much in the paper from which one could grasp the practical efficiency of what had been suggested, and after that all what concerned them most was the practical application of such suggestions to their own trade as coachbuilders. First of all he could not help thinking that iron would be a very bad substitute for steel. The professor mentioned iron in particular, and made a point of the necessity of purity in iron, and also of the difficulty of it being strong enough for its purpose. He (the speaker) could not help thinking that both these difficulties could be got over. The question of the purity of iron seemed to him to be one of price. If iron sheets cost a little more he thought they would be repaid manifold owing to the ease of working it and the freedom from trouble.

It must have been the experience of many of them that a panel or set of wings went wrong and had to be replaced time after time at great expense, and there was obviously a tremendous leakage of what should be profit, and whatever iron cost, as long as it was suitable for their object, he thought it would be economical in the long run. There was a suggestion from an American source that before long they would do away entirely with metal motor guards, and go in for 3-ply and 5-ply guards, but with that theory he had not the slightest sympathy at the moment. Unless they could seal the edges with metal their object would be defeated, and it sounded impracticable. The main cause of the trouble to his mind was the question of the care that was taken after the steel was manufactured. Taking it for granted that it was really high-class steel, it might have a little couple in it of some other substance which would cause corrosion if the steel were handled as ordinary steel was, and they were in trouble before they bought it as the rust was there. If it were possible to bring pressure to bear on the manufacturer to see that the quality was good and that proper care was taken in handling the sheets he thought they would have gained a great deal. With regard to the point in the paper as to the best way of eradicating rust, they had tried burning off every particle of paint, sandpapering the panel and using paraffin and benzine in order to eradicate the rust, but so far as he knew the result had not been a good one, and whatever they did they knew that the next time the car came into their works there would still be signs of rust. He would also like to know whether anything could be used instead of lead, because he thought the action of lead on a panel where damp had struck must be the cause of a great deal of the trouble. Professor Bannister had suggested red lead as being better than ordinary white lead, but he (the speaker) seemed to remember that in the olden days red lead was extensively used, so that their forefathers knew a great deal more than they knew at the present time. He would like to know whether there was any cheap and ready method of analysis which the coachbuilder in a small way might utilize; could it be done in an ordinary workshop?

A. C. Penman (Dumfries) said the paper was extraordinarily interesting, but they were not chemists, nor were they scientifically trained in these things, and one of their greatest difficulties had been that they were so frightfully ignorant; they had to take things as they got them, and make the best of them. There were so many chemical and electrical actions going on of which they did not know, and if they could buy with safety they would be free of a lot of their troubles. He thought they would be greatly benefited by more instructions as to the care which they should take of the steel after they received it.

A great many of their difficulties had proceeded from carelessness and ignorance in the matter of treating the steel sheets after they received them. With regard to the suggestion that the parts that first showed corrosion were those parts which were beaten, his experience was that those parts which were beaten most severely had not troubled them; most of the trouble had come on the doors where there was no beating at all. Another thing he had learned from the paper was that burning was the most effective way of cleaning, and that had practically been neglected. They had tried every other method but burning, and he could see that this would deal with some of their difficulties. He well remembered that long ago they used red lead as the under coating on carriage work of good quality, and he rather wondered if chemically it would have any effect on the tinting coats more than white lead had. It would be interesting to know whether there would be any ill effect from the use of red lead in this connection. There was one way out of the difficulty, and that was the substitution of wood for steel. There was no doubt that the old wood bodies stood a good deal more than the steel bodies did.

W. Lawton Goodman said those who had employed, and still continue to employ, steel for panels and other portions of the construction of motor cars had had the unfortunate experience of having a great deal of their work to do over again in order to give satisfaction to their customers, and this had to be done at the expense of their own profits. Personally he had no scientific knowledge of the component parts of steel, but he had had a long and workmanshiplike experience of its use, and his experience taught him that the rust was in the metal when it was received into their factories. It might require a microscope to find it, but after it had been worked and all the labor put on it and painted and varnished the result had been, in too many cases, that all the work had to be done again.

There had been pitting of rust in the wings notwithstanding red lead and white lead and other things when

the surface had been exposed to the weather, and there had been those pockets which the professor had had his scientific eye upon which had become larger and larger, and had necessitated the eradication of the paint and the redoration of the carriage. Personally he did not any longer use steel for panels; he used aluminum, which he found eliminated the difficulty they had found in the past with regard to rust. He was afraid all the troubles they had spoken about would remain with them until such time as the steel manufacturer was able to hand to them materials of such a character as would obviate any chance of trouble in the direction which had been indicated in the paper. In his opinion the use of steel in the manufacture of motor bodies should be eliminated, and aluminum used in lieu of it, whereby they would give greater satisfaction to their customers, and at the same time have greater profit for themselves. Steel was used now because it was less expensive, but he claimed that it was more expensive because of the number of jobs that had to be done over again, and in the long run the cost of aluminum would more than cover the expense of the makers.

J. White said the question of metallic zinc had been mentioned by the professor. In his experience as a practical man metallic zinc was the worst possible metal that could be used. He had had nothing but trouble in its use. He was glad to hear the suggestion about red lead; for a long time they had had the same trouble with his own works. If the metal was bad it was quite impossible to prevent rust, but his experience was that if they got a very excellent silver finished panel specially made, and if proper care was given to that panel there was very little real trouble of having the rust difficulty afterwards. If the nickel sheets were carefully covered when they came into the works, and care was taken that they were dealt with in a proper manner there was very little danger of the rust difficulty arising. Personally he had not had a single instance for 18 months. It might be that he had dropped across the right metal, but he felt that with ordinary care it was possible to obtain good results with ordinary metal. He supposed many of them had lost hundreds of pounds owing to this rust difficulty, but he thought if proper attention was paid to the valuable hints given in the paper of the professor it would help in a remarkable manner to solve the difficulty.

G. W. Eastwood said that apparently most of them were in the same boat with regard to corrosion, but the fact that the boat was sinking did not afford very great consolation. In had occurred to him that it would be a good thing if their institute would offer prizes for the study of chemistry. They all knew that the construction of a carriage, whether horse drawn or for a motor chassis, involved the inclusion of practically every type and kind of metal and timber. The average coachbuilder knew something about springs and mountings, and timber and silk and leather and other materials, and it was now plain that he had to bring in some other knowledge as well, and that was a knowledge of chemistry. His experience of the laboratory was that it was not very helpful, and what they really wanted was to get the chemist and coachbuilder together in order to find out not only what was the trouble but the way to remedy it. His experience was that he had got from chemists when he submitted a problem to them, a report in language which was not understandable by himself or any of his colleagues, and was it not possible for the chemist to find some language which they could all understand?

With regard to the steel, if they went to the manufacturer of the steel they would be told that the steel was all right, and that the fault lay with the paint; then when they went to the paint manufacturer they would be told in turn that it was the steel that was faulty, and there should be some means to bridge the gap between the laboratory and the workshop by which to get over the difficulty. Aluminum had been mentioned as solving the rust difficulty, but he would like to hear from the professor if that was really so; although aluminum did not resist, did it corrode? He would also like to hear from the professor whether there was any chemical difference between red and white lead. Possibly the institute might be able to do something with the steel makers and the paint manufacturers, and he wondered whether it was possible for the institute to bind the steel makers down to some guarantee.

W. W. Davidson said the coachbuilder today was in the same position the chassis maker was in some years ago; they had the soft steel, and their gear boxes would wear out in no time owing to the quality of the steel. It was no use going to the steel maker, who would say that he could do nothing more; the only thing for them to do was to help themselves. If the institute would establish a committee of research he thought they would achieve the result much faster than if it were left to individual effort. He had been associated with the steel industry all his life, and had gone through all the difficulties that had come up against the chassis manufacturer in the production of steel. He thought that the price of the steel specified by the professor in his paper was prohibitive today.

What they wanted to arrive at was a definite specification for a steel sheet that would bring satisfaction to all to a far greater extent than was possible today. He thought they should take to heart the most interesting paper they had heard, and concentrate on something. The chassis manufacturers had left them cold as regarded the scientific point of view, because they had established in the olden days a chemical laboratory, which, they, as coach builders, laughed at and said was no use, but they knew better now, and they as an institute ought to give careful thought to the scientific aspect of the matter. That would be to the advantage of them all, and he knew that the iron manufacturers would be only too ready to adopt any suggestions that came before them from a practical point of view. With regard to aluminum, he had tried it and found it satisfactory in its own way, that was if it was produced for the ordinary car that moved round the country, but it had been found unsuitable for cars that were used at the seaside. He hoped as a result of the paper which they had had that something would be done which would be of real use to the trade, and which would obviate the spending of hundreds of pounds, which was really unnecessary.

W. Nicholls said the paper had convinced him that they must look to the steel manufacturer and the chemist to get them out of their difficulty; it was beyond the practical province for them to correct the difficulty themselves. The position was that they must concentrate on getting over the difficulties they were told must necessarily arise while the steel sheets were manufactured as at present. With regard to the use of red lead, some builders feared its influence on other coats of paint. Personally, his firm

had applied clear varnish, japan, japanned varnish, red oxide, red lead and oil, and with all of them there had been some trouble.

James Penman said they had tried aluminum, and had to go back to steel. Steel was bad, but aluminum was not the solution of their difficulty. Apart from the action of salt where aluminum was welded, after six months the line of the weld would take on a greyish corrosion, and that had been their trouble. A plain aluminum sheet had been all right, but where there had been a beaten surface there was welding, and there corrosion had taken place. It was not as bad as rust, but it was there, and spoiled first class work. They were trying to cut the beaten metal down and use wood as much as possible, but so far as metal was concerned they were still at sea; they did not know enough about it, and aluminum was not an entire way out of the difficulty.

A. C. Weels asked whether Professor Bannister had had an opportunity of examining any American products, as the trouble they had been considering was not so prevalent in American models. If it had not already been done he thought some good might arise if the institute officially approached some of the chief metal manufacturers associations on the whole subject.

Reply on the whole discussion Prof. Bannister said that the questions of purity and price would undoubtedly have to be borne in mind, and probably one of the best methods of solving the problem of corrosion would be to get somewhere near pure metal. The question of price would have to be left to the manufacturers. Mention had been made of getting back to iron, but he warned them that it was not the old-fashioned puddle iron that they wanted; they would find it in Armco iron which was made in a steel furnace, though not steel. In regard to the cases where they had repeated rustings he felt sure in his own mind that it was due to the metal itself, and not to their treatment of it.

The cost of analysis had been mentioned by one speaker; of course analysis was a very expensive thing, and for firms, except those on a big scale, it was impossible. They not only wanted a chemist who could actually determine a thing, but one who could interpret the results and discuss them in a common sense manner with a non-chemical mind. It required not only training in chemistry, but long experience to interpret results and put them into common sense language. The only possible way was by combination. Exactly the same applied to the cost of investigation; as they would have gathered the problem was extremely involved, and was one of the most difficult, because they eliminated one cause of trouble and immediately came across another, and investigation would be slow and expensive.

With regard to the question of beating, which had been mentioned by Mr. Penman, that was one of the points that illustrated the difficulty of the problem. He agreed with Mr. Penman that in certain instances excessive beating would reduce the possibility of corrosion, but in itself it was a cause of corrosion. The portion between a beaten and unbeaten part would corrode more rapidly than if all were beaten or all unbeaten. Steel, wood and aluminum had been mentioned as alternatives; he was a metallurgist, and would naturally not like to see them adopt wood; he would be sorry if they dropped metals for something which was non-metallic before they had given them a good chance.

Burning was, no doubt, a good method in preparing surfaces before treatment, because by burning they were getting rid of rust. Even with aluminmu their troubles would not end; if aluminum were used on a large scale they would find their troubles increasing as the amount of aluminum was increased, because all sorts of unknown difficulties would arise, such as atmospheric and seaside air which would have their effect. It had been suggested that coachbuilders should leave metal to the steel maker; that was no good, because if they did not use metal and take an interest in steel, the steel makers would not. It was only by cooperation between the users and the makers that any beneficial results would be obtained. He only mentioned zinc-coated metal to give an example of its effect; he should not for a moment think of using zinc coating for steel bodies. There was a great difference in the chemical constitution of red and white lead, and from his own experience he had found that red lead was the more reliable. There was a considerable difference between parcels of white lead, and occasionally they came across white lead which was extremely detrimental, and would assist corrosion rather than avoid it. Mention had been made of trouble arising from the welding of aluminum, but that would be probably due to the flux used or improper welding operations. In conclusion, the professor, who was accorded a hearty vote of thinks for this paper, thanked the members for their cordial appreciation of his paper.

Expansion Plans of Ford Motor Co. of Canada

The Ford Motor Co. of Canada has definitely entered upon its expansion project announced some time ago, when the company was reported to have acquired extensive real estate holdings adjoining the present site of its plant at Ford City, Ont.

According to Walter R. Campbell, vice president and treasurer of the company, the project includes the erection of docks and storage facilities on the river front, a power plant and machine shop which will, when completed, enable the Canadian Ford company to increase its output 60 to 100 percent.

The power plant and pumping station will be large enough to supply the entire manufacturing plant with power and water for many years to come. All electrical wiring and piping for water, gas and heat for the various buildings will be carried through tunnels.

The first development will be the large machine shop to be erected on the 50 acre plot between Grand Trunk right-of-way and the Essex terminal. The building will be one story, steel, 578 x 1080 ft. long. With this additional space the company will be able to increase its production more than 60 percent.

On Oct. 25 an order for 2,800 direct current motors was placed. Vice president Campbell estimates that by May 1, 1923, the new machine shop will be ready to enter upon the new production schedule which has been set at 75,000 cars for the year. Under present conditions, the output for the firscal year ending July 31 has been 45,000 and for the calendar year about 50,000 cars.

Hardwood Manufacturers' Institute, whose membership comprises various hardwood manufacturers, has moved its offices from Memphis, Tenn., to 1020 South Wabash avenue, Chicago.

All-Weather Touring Body of British Design for Delage Chassis

Details of a Smart Appearing, Carefully Designed Body Intended for All-Year Touring in England—General Dimensions—Framework Sizes.

WHILE the all-year body has made great progress in this country, it has not done so in many others, especially north European countries, principally because these are not subjected to the same extremes of temperature. However, in England they have many very disagreeable days so that a car to be a truly year-round proposition must have some kind of enclosure to provide against these inclement days. Considering all this, it is of especial interest to all automotive manufacturers and body designers especially, to examine this design by a prominent British firm for use on the French Delage 24 h.p. chassis. The body is shown in Fig. 1, which is a reproduction of the working drawings for this job, and the chassis dimensions are shown in the sketch, Fig. 2.

and any saving of a few pounds here and there will be found to total a considerable amount in the finished work, as it will also be a saving, in the cost of production and in use. There has long been a prevailing idea that weight represents strength, a fallacy long since discarded by practical men. Every pound of superfluous weight represents initial waste of money, in the shape of extra labor and material, with extra expense in the running of the car.

The adoption of the Gwynne patent hood with its door pillar attachments for windows, enable the body designer to produce an exceedingly light body structure, indeed it is not too much to say, that weight is reduced quite 50 percent, and if the body is constructed throughout on the methods explained, the total weight should not

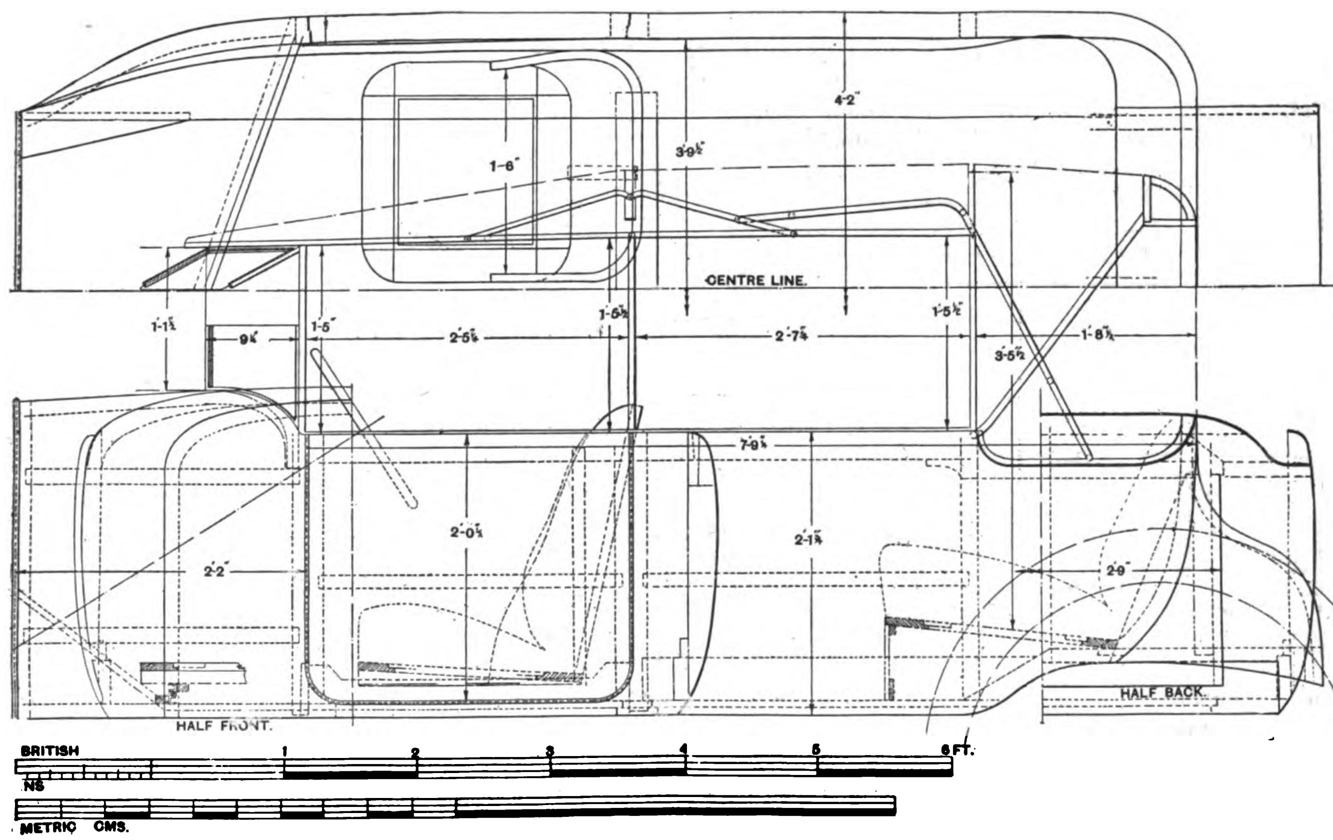


Fig. 1. Detail body drawing of all-weather touring car on 24 h.p. Delage chassis.

The design of this all-weather body, in which the details of construction, together with the application of the Gwynne patent hood, are shown in the accompanying working drawing, represents an extremely interesting model of recent body development, of a type, that shows considerable progress in a practical manner, towards simplicity, and protection, as well as lightness in weight. There is undoubtedly a strong demand in this country for this class of body, providing reasonable passenger carrying capacity is secured, and in which the question of weight has been considered both in the body itself, and the movable head structure, that converts the same from a comfortable closed carriage to an open one.

Weight is of primary importance for economical use,

exceed 3 cwts. as compared with 6 or 7 cwts., that is very usual. With this fitting we are enabled to dispense with heavy cant rails and pillar tops, while the folding top in its entirety with the window attachments, permit of exceedingly light standing pillars, that will be found to stand up to their work well, if they are stayed in the right direction. The body further is not likely to have the strain of the ordinary wood pillars with an automatic spring action, thus the bottom side framing can be much lighter in thickness, a part in which considerable amount of weight may be saved. A reference to the plate shows that the design is quite evenly balanced, and makes for an attractive, smart and comfortable body.

The two side windows are evenly balanced, with a 30 in.

door, the length of body being such, that the whole of the hood, when open, lies in a compact unobtrusive style, there being little projection beyond the mudguards, while at the same time there is no mass of heavy leather resting on the back part of body. The light framework is of English ash, with aluminum panelling B. W. G. 20, and from the sectional views it will be seen how the panelling of the top rail is turned over, the elbow rail of the hind quarter being dropped from the elbow line 3 ins. After the panel is turned over, hard wood fillets are fitted on the top, to which the head leather is fixed on the outside, and the upholstery on the inside.

It will be seen that there is only one cross bar actually in this body, a light bar being framed to the extended boot, the back seat rail being fitted on the bottom, further stiffens this part. The standing pillars in their full back panel on the top edge. In fixing the panels as before mentioned, by being turned over on the top, much stability is given to the body sides, as they, so to speak, lock the framework, and its joints together.

The doors, in their framing, are exceedingly light, and it will be seen on the shut side, there is a vertical batten some 4½ ins. from the pillar. This is to take the patent lock, which is a feature of the Gwynne fitting, as the door handle spindle does not go through the door in the ordinary way, but linked up with the inside handle, that is kept below the window rest. It might be assumed, that in a wide door of this light form of framing, there would be a difficulty in it retaining its shape. To counteract this, a wide garnish rail ½ in. thick is carefully fitted, well screwed in, and as the door bottom is well fixed, the doors are very stiff.

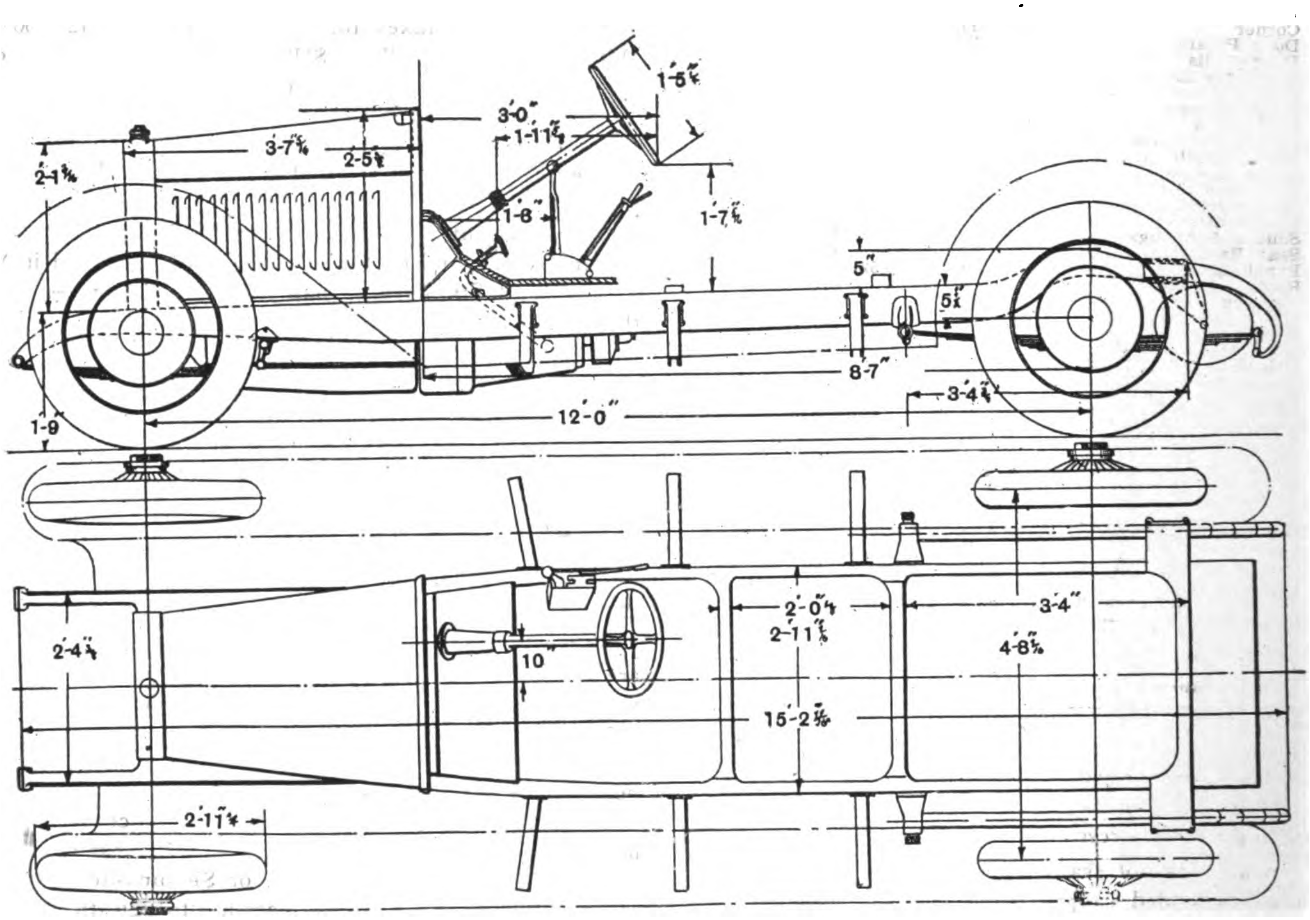


Fig. 2. Body builders' drawing of the Delage chassis, showing dimensions of important parts.

thickness are but 2¼ in. by 1¾ in., framed in the usual manner with a light top rail. On the inside of these pillars are screwed the head fittings, No. 4 in size, and being in one complete unit, little difficulty will be experienced in fixing the same. The standing pillars are plated with a 1¼ in. by ⅜ in. corner plate, that is fixed on the edge of the cross bar, the corner being cranked over, and turned to go up the inside of pillars. At the bottom part the plate is fixed with two 5/16 in. bolts, that are judiciously placed, so as to get stiffness at this part. It will be seen that a number of body battens are dispensed with, the back part is built with two back pillars, the outside of each taking the back boot framing. The rear quarter elbow is lapped on straight, the round corner and back rail being built up with light ash bracket pieces, spliced to the back rail, and shaped out to the desired line of the

From the plan drawing can be seen the position of the seats, and shape of the rounded corner of back part, while the profile drawing gives the sectional view through the body side, that can be easily and clearly read by the body maker for the layout and preparation of the full size drawing to take this folding top and body equipment. A point to be noticed in a design of this description is that a large amount of expensive sheet metal work is dispensed with, as the body maker can easily fit and fix the side panels, it only remains for the corners and scuttle panels to be shaped by the panel beater. Working to the drawings and measurements supplied will result in the production of a body, unapproachable for lightness in weight, while experience has already shown the patent fitment to be "sound in principle," practical in application, accurate in construction, as it is efficient in working, most

desirable features in a convertible car. (Cooper's Vehicle Journal).

General Dimensions

	ft.	ins.
Length over all on bottom of body	9	9½
Length from dash to rear quarter light	7	2¼
Length over all on elbow line (measured square)	6	9¼
Length from dash to shut pillars	4	7½
Width of doors	2	5¼
Depth of body sides in center of door panel	2	1¼
Depth of V front screen		9¼
Head room above the rear seats	3	5
Width over all on shut pillars	4	2
Width over all on bottom	3	7
Width across rear boot panels	2	9

Details of Framework

No. of Pieces	Part	Material	Length ft.	Length ins.	Width ins.	Thickness ins.
—	Runners	—	—		—	—
2	Bottom Sides	Ash	9	9	7	1¼
2	Cross Bars	"	3	0	3	1¼
—	Rocker Pieces	—	—		—	—
2	Front Standing Pillars	Ash	2	1½	2¼	1¼
2	Hind Standing Pillars	"	2	1½	2¼	1¼
—	Hinge Pillars	—	—		—	—
2	Back Pillars	Ash	2	1½	2¼	1¼
—	Pillar Tops	—	—		—	—
2	Corner Pillars	Ash	1	9	1¼	1¼
4	Door Pillars	"	2	0	2	1¾
2	Door Rails	"	2	4	2½	1¾
—	Door Top Rails	—	—		—	—
2	Door Bottom Rails	Ash	2	4	3¼	1¾
2	Door Battens	"	2	3	2	1
—	Cant Rails	—	—		—	—
1	Front Top Rails	Ash	4	1	1¾	1¼
—	Front Middle Rail	—	—		—	—
1	Back Rail	Ash	3	2	1½	1⅜
—	Hind Top Rail	—	—		—	—
—	Hoop-sticks	—	—		—	—
2	Body Battens	Ash	2	5½	2	1
5	Scuttle Framings	"	2	1	1	¾
2	Seat Rails	"	3	8	1½	1¼
—	Panelling	Aluminum	52		super.	20bwg
—	Roofing	—	—		—	—
—	Flooring	Yellow Deal	18		super.	¾
—	Lining Boards	Pine	14		super.	⅜
—	Solid Sides	—	—		—	—
—	Step Pieces	—	—		—	—
—	Polished Fillets	—	—		—	—
—	Inside Panelling	Whitewood	6		super.	¼
—	Canopy Bends	—	—		—	—
2	Running Boards	Amer. Ash	6	0	11	7
2	Rocker Sides	Mahogany	1	9	17	⅞
—	Screen Pillars	—	—		—	—
—	Heel Board	—	—		—	—

Hungary Wants American Cars

Hungarian dealers in automotive products are unable to fill the orders they have on hand from their usual sources of supply in Germany, Italy, Farnce, and from their domestic factories, and they want American cars, says Vice Consul Willson in a report to the automotive division of the Department of Commerce. One of the leading dealers in Budapest is confident that he can sell at least 250 low-priced American cars, 200 medium-priced cars, 50 high-priced cars, called the "Luxus" type in Hungary, and 200 motorcycles.

Hungary has not snared in the vicissitudes of Austria. Her great landed proprietors still have their land, and they control the government, it is said; the peasants and villagers are prosperous from the sale of their products to less fortunate neighboring countries, and the purchasing power of all classes is declared to be relatively high.

Imports during the first nine months of 1922 have totaled 136 more passenger cars and trucks than imports during the entire year of 1921. A significant fact in the price of motor vehicles imported from other European countries, is that they have increased in dollar cost from 25 to 35 percent during the past four months. This is, besides increasing in value in Hungarian crowns. On account of depreciating currency, they have also increased in price in U. S. dollars. This naturally adds to the compatibility of American motor vehicles in the Hungarian market.

The present market for passenger cars has been limited to the sale of six-cylinder models because of the impossibility of obtaining four-cylinder models from European manufacturers. Five-passenger cars are not at all popular and roadsters are not to be had. Seven-passenger cars are in demand and it is believed that a good medium-priced roadster would find a good market in Hungary if proper advertising methods were employed.

Dealers are said to be willing to pay cash for American cars and trucks, if necessary, although desiring to secure more favorable terms with bank guarantees.

It is especially necessary that American manufacturers stipulate when quoting prices all discounts which the manufacturer extends to the trade.

Henry Ford's Wealth

The Wall Street Journal says:

Henry Ford has in the Ford Motor Co. the largest income and, if capitalized, the largest fortune in the world.

Profits before taxes for 1922 will exceed $125,000,000. After taxes they will be $110,000,000, about $100 a car. With these earnings the Ford Motor Co. could be capitalized at $2,000,000,000 and pay 5 percent on that capital.

Ford condemns bankers, but with $180,000,000 cash he himself is the largest individual banker in this country, if not in the world. Michigan sugar beet growers and automobile manufacturers have little need for such a stupendous sum and only a few millions are banked in Detroit. Wall Street—the finance of the country—absorbs the other millions and Ford accumulated profits expand and multiply with Wall street assistance.

In his newspaper interviews Ford says that Wall street and the gold standard have outlived their usefulness, but his millions flow through to Wall street at 4 percent to bring his company a possible $7,200,000 gold standard money annually in interest. This is more than $6 for every car he produces.

Even a Republican congress unites to add to the Ford wealth. The company paid more than $50,000,000 in federal taxes in 1921. Because of the abolition of the excess profits levy, it will pay only $16,000,000 in 1922. The Fords are $34,000,000 richer, though if they were to draw the riches out they would pay more than 50 percent additional in personal income taxes.

So Ford continues to pile up in his business the millions which find their way into Wall street. His replacement parts business is so profitable that he could chop off his manufacturing profit of probably $80 a car and make more than $15,000,000 annually, or $14 on each car produced from the sale of parts neeessary to keep the millions of Fords now on the roads in running condition.

He could distribute this $14 as a bonus to his workmen and still make the $6 a car profit from interest.

But he is not selling at cost. He is holding on to profits from interest, parts and cars: $58,000,000 in the record 10 months ended last February, despite the heavy taxes; $110,000,000 in all probability after taxes in 1922.

Henry Ford is a Wall street in himself and the few blocks of Woodward avenue running past his factories in Detroit form a companion thoroughfare with the few blocks of Wall street from Trinity Church to the East River. His income, adding to his boundless wealth $500,000 a day through the busy season, is probably unequalled in all history.

If he continues to pile up cash at this rate he can not long denounce Wall street, or the money power of the country.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIV NOVEMBER, 1922 No. 8

Production Holds Up Strongly

DETAILED figures on the October output of motor cars is not available but unofficial figures seem to show that the production was considerably above that of last year's October, and a reasonable approximation to September. In the latter month the output aggregated 206,000 vehicles, while last October the total was 147,000. This year, the figures have been running uniformly more than 20 percent above 1921, while the more recent months have been closer to 30 percent above the corresponding months of last year.

If October was as much below September as that was below August, namely 12 percent, it will total around 182,000. If, on the other hand, October was 30 percent above the same month last year, it will total around 181,000 or almost exactly the same figure arrived at in two ways.

Granting that the correct figure when announced, will prove to be not less than 180,000, the year's total, without November or December will approximate two and one-quarter millions, a new high record. It is not entirely unreasonable to assume that the two remaining months may show a total not far from 250,000 (November 150,000, December 100,000), then the year's aggregate of cars made and sold will round out an even two and a half millions.

There are some who think that too many cars are being produced, but so long as the manufacturers can sell them faster than they can make them, they will hardly agree with the pessimists. Numbered among those optimists is Henry Ford, who plans, so the report goes, to produce not less than two million cars next year. Considering the relation of Ford 1920 and 1921 output to the rest of the manufacturers, this would indicate a total production well in excess of three millions.

Whatever the 1922 totals may work out at, and whatever production may be planned for 1923, the actual figures indicate that the old bogy, the saturation point, is just as far away now as it was four or five years ago. In fact if prices keep going down, and thus, the circle of possible buyers is widened out continuously, such a point may not be reached for years to come. Certainly, with Ford touring cars below $300, there are very few families in the United States who cannot afford one. Should the same old $50 annual reduction materialize next summer, it will almost be true that every family can afford one. It is estimated that there are more than twenty million families.

Even with 13,000,000 in use, there would be a virgin field for close to 7,000,000, which would mean two years at record figures or three at the present levels. By that time, with close to 20,000,000 in use, the annual replacement business will approximate this year's apparent total. Consequently, considering the figures very closely, automotive manufacturers have nothing to fear except many, many years of business, continuously good business.

Later reports put October at 244,000, actually exceeding September by 20 percent, so all that has been said above is extremely conservative.

The City Traffic Problem

TRAFFIC problems in our larger cities are growing rapidly and are approaching the point, under greatly increased automotive traffic, the point where existing facilities are not adequate to cope with them. Point is given to this statement by the recent utterances of Police Commissioner Enright of New York, who stated publicly and frankly at the annual dinner of the Fifth Avenue Association, that the police department was at the end of its rope, that it was handling the utmost quantity of traffic, and that the handling of additional traffic, which is as certain as tomorrow, was an impossibility.

He suggested the need for a large number of additional traffic policemen (perhaps 1,000 to 1,500), the elimination of the Sixth avenue elevated structures to permit increase of traffic on that avenue, similar action on Second avenue to open up the East Side of New York, and the building of an elevated, marginal roadway restricted to motor traffic alone. The last suggestion is not a new one, having been made in more concrete, detailed form several years ago by the well-known engineer, T. Kennard Thompson.

A short consideration of the radical nature of these conditions for improvement will convince anyone how serious a matter it is. The building of an elevated street of say 50 ft. width could easily absorb fifty millions of dollars, the removal of the two elevated structures would mean as much more. The employment of 1,500 additional traffic policemen would entail an annual expenditure of close to three millions. The interest on the other money would come to five millions annually. Here is a remedy which might be effective for not to exceed five years calling for an initial outlay of perhaps one hundred millions or more and annual charges exceeding eight millions. Truly the situation must be a desperate one, and one which all city planners should weigh carefully. Nor is this the end.

The recent reduction of 5d per gallon in the price of gasoline to the dealer and 5½d to the consumer has caused a considerable stir in Great Britain, and it is naturally expected that the demand will increase accordingly. It is expected that this reduction will result in increased sales of passenger cars and other automotive vehicles.

Increased Efficiency Through Foremen Training

BY B. M. NUSSBAUM*

How Adequate Training and Education Improve the Foreman's Ability to Handle His Men and Work, and Thus, Lighten the Manufacturer's Load.

THE superintendent of a western foundry stated recently that the production in his plant had notably increased as a result of foremen training. "The tonnage per man hour averages several percent better than it did before we had the trianing," he said, "and the tendency toward economy and improvement is everywhere evident."

From a toolmaker in an eastern plant came this concise estimate of the results of a foremen's course in his organization: "The foremen are more alert. Our department has undergone a change. No junk lying around, benches rearranged, the room is the same but there seems to be more floor space."

In a machine shop the industrial engineer reported a decrease of approximately 50 percent in labor turnover—a result which he attributed to the course in foremanship recently given in that plant.

"The truth is," said the manager of a factory making an important accessory, "there is no means of increasing production efficiency that is so immediately resultful as foremen training. No matter how wise and alert and energetic the executives in the office may be, all their plans and proposed improvements depend on the foremen. If the foremen don't understand them or don't warm up to them, they won't get across. Whereas, if the foremen are thoroughly 'sold' on a new method or policy, the management can depend on them to put it across in great style. The foremen is the most important man in his department. He ought to be more than merely the star workman; he ought to be an alert and capable representative of the management, a skilled leader of his men, an intelligent member of the general plant organization. Many foremen are narrow specialists because they are workmen who have been promoted and thrust into a foreman's job with no special preparation for its responsibilities. That is why we have so much indifference and even opposition to new policies and methods when they mean changes from established routine, why we have men and departments sometimes working at cross purposes, high labor turnover, limited production, excessive spoilage, and all other things that eat up profits. I have known more than one plant in which the training of foremen in fundamentals of their job led to an entirely new condition of affairs and directly increased the production."

The picture of the average foreman which this executive draws is not peculiar to the automotive industry. I would be inclined to say that foremanship in the plants devoted to the manufacture of automobiles, bodies, parts, and accessories is on the whole some notches better than that of the average of all American industries, and many notches ahead of that in some I might name. And yet, I believe the portrait as drawn is fairly accurate. Plants are handicapped by faulty foremanship. The efforts of a progressive management are frequently thwarted, or at least seriously impaired, by the indifference or negative opposition of an unsympathetic department head. Every industrial engineer has had his experience with the type of foreman who tells his men to "fergit it" when the organizers are on the other side of the door. Almost every plant manager or superintendent can tell of instances in which an enlightened labor policy has been brought to naught in some department by the crude tactics of an over-bossy foreman.

The remedy for faulty foremanship is to be found in foreman training. But here we come upon a much handled subject. In the period during and since the world war several types of foremen training have been devised, so that the term does not mean the same thing to all who use it. My experience has been with a system of group training in foremanship fundamentals which has been used with admirable results in such plants as the Hyatt Roller Bearing Co., Martin Parry Corp., Biddle & Smart Mfg. Co., the Delco Light Co., Sparks Withington Co., Splitdorf Electric Co., Standard Parts Co., Warner Gear Co., Wilson Body Co., and the Gilbert Barker Mfg. Co. Each of these plants had problems peculiar to itself which the training was desired to affect, but all were concerned with the basic problem of improving the quality of foremanship.

The problem is not a simple one under any conditions. It is not easy to hire capable foremen, ready made. By the simple act of promoting a good workman you do not make a capable foreman. Foremanship is not exalted workmanship. It is, one might almost say, a trade in itself, calling for three kinds of abilities: (1) technical ability in the processes and with the equipment of the department, (2) managerial ability in handling harmoniously the employes of the department, and (3) cooperating ability, by which I mean the faculty of working smoothly and intelligibly with the other departments and with the general management.

Most foremen are able to qualify in the first of these requirements: they are good workmen, skilled in the technique of their departments. But in the other two abilities the average department head or gang boss is lamentably lacking. He is not a good manager of men largely because he has never been trained in the principles of leadership and executive control. And, as a general thing, he is not an alert capable cooperator with his brother foremen and with the plant management because he knows little of the plant as a whole and still less of industry in general. He thinks in terms of his particular department, in terms frequently of routine work that has been carried on without change for many years. The common difficulty of introducing improvements in an established department, not to speak of the even more difficult task of getting the foremen themselves to originate improvements, is therefore not to be wondered at.

The training system used in the plans named upon the above analysis of the foreman's threefold functions. It recognizes that the average foreman is already well-informed in the technique of his department and is not at-

* Vice president, Business Training Corporation, New York.

tracted toward a rehash of what he knows or thinks he knows. The training is therefore directed toward broadening his grasp of production principles, with special emphasis on such subjects as self-analysis, organization teamwork, handling men, utilizing equipment, production records, and management. The purpose is both to inform the foreman with basic knowledge and give him a body of fundamental principles which he can apply in his own department, and also to inspire with a view of the great teamwork of production and of his own part in it.

To accomplish this end, four things were found necessary: (1) the application of each foreman individually through study of the teaching of the course; (2) the leadership of the foremen's study through lecturers or group leaders; (3) practice work by foremen in the application of the teaching, and (4) the training of the foremen in groups.

To meet the first of these requirements, carefully prepared study material was used. The foremen were provided with text books specially written from their angle of interest and in a style both simple and concrete. The records show how successful this material has been in getting the foremen to study; instances of 100 percent completion of study work are not unknown, and records of 90 or 80 percent completion are numerous.

The second essential was provided by having lecturers to reinforce the text-material. The lecturers were men well versed in industrial principles and methods who were able to give individual application to plant and departmental problems. At the same time the lecturers by their personalities were able to add inspiration and enthusiasm to the group meetings.

Practice work was provided through a series of factory problems which the foremen-student had to solve and hand in in the form of a written report. The problems were closely tied up with the text material, so that through a man's problem solutions it was possible for the instructors to judge his mastery of the teaching of the course. But even more valuable was the added interest and stimulus to work which these problems brought to the training. Most of the foremen accepted them as a stunt to be performed. In many plants a wholesome rivalry developed among the members of the study group and results were eagerly watched.

The final requirement—that the foremen be trained in groups rather than individually—is necessary if the improvement of a plant's foremanship as a whole is desired. Individual training may develop a star foreman here and there, but for all-round development of the foremanship as a whole group training seemed essential. This was accomplished by having the foremen students meet together at weekly or fortnightly intervals, on company time usually, for questions and answers and discussion. One especially fine result of these meetings was the fellowship and better understanding which it promoted between the various department heads, many of whom had never gotten together before in meetings.

This training plan, as used in the companies named, was employed to accomplish for the factory squad-leaders what the non-com schools of the army accomplish for military squad-leaders. It gave backbone and strength to the plant organization, strengthened the morale of the foremen as well as opened their eyes to new ideas. Moreover it accomplished these results immediately and progressively. A plant does not have to wait until the completion of the course to begin to reap its benefits.

"Immediately after we had started the training," said A. B. Bolender, general foreman of the Warner Gear Co., Muncie, Ind., where a group of 100 foremen were entered for the training, "I noticed a more hearty cooperation among the different department foremen. They were trying to help each other out of their difficulties to a much greater extent than I have ever seen in a bunch of foremen in a shop of this size. I can also see plainly a big difference in the way they handle their men. They go at it in a more tactful way, and they seem to be more interested in the welfare of their workmen. Most of the foremen are now doing more studying of conditions in their department, and are also starting a system of planning their work."

Much the same report was given by W. G. Price, employment director of this company: "Our labor turnover has decreased to a certain extent in the short period that we have been studying this, and there seems to be a more friendly spirit throughout the shop in general."

And E. B. Baltzly, assistant general manager, summed up his observation of the results of foremen training in the Warner Gear Co. as follows: "The benefits derived from the study are immeasurable, as the foremen are getting a new light on the ways and methods of handling their men and their departments, which, in the end, tends toward increased production, decreased cost, with better paid and satisfied workmen."

In the Biddle & Smart Co.'s plant at Amesbury, Mass., where closed bodies for many of America's finest automobiles are made, a group of 67 men, including foremen and other department heads, inspectors, and a few picked workmen, were enrolled. At the end of the three months' training E. M. Stephan, secretary to the factory manager, wrote: "In our production records we know we have had closer cooperation from the foremen during the past half year than at any time during the three years previous. There has been the will and spirit to come across, and this, as you know, counts for increased production."

A foreman in the Hyatt Roller Bearing plant at Newark, N. J., gave his estimate of the training at the finish of the course in his plant where 134 men were enrolled: "I find that this training has greatly broadened my insight in manufacturing methods and has shown me clearly the functions of the various departments. It has also furnished me with a splendid foundation for further study in production methods." Another foreman in this same plant said that he was already making more use of the plant library, and had planned a course of advanced reading in production subjects for the coming year.

The vice president of a Detroit company, in giving an account of the effect of foremen training upon the human relations within his plant, said among other things: "I have noticed a very decided improvement on the part of two of our men, one of whom has materially tempered the erratic qualities which usually go with a crop of red hair, and the other of whom is making a sincere and pretty successful attempt to control a nature that has been wont to break away from restraint in dealing with the men and the foremen about the plant."

Perhaps one of the most striking evidences of the training is the changed attitude of foremen toward progressive ideas, improvements, and continued education. In one plant the management had organized a foremen's club

through which it hoped to interest its department heads in modern methods, but the club was fast proving a failure; the foremen were indifferent, took no interest, and attended as though it were simply to favor the management. Finally a course in foremanship training was introduced, a majority of the foremen enrolled in it, and after that the club suddently revived. It took a new lease on life, and since the completion of the training course has become the successor in carrying on its educational work. The club provides a clearing house for the foremen's discussion of their department problems and is a valuable adjunct to the efficiency work of this plant.

Very often the foremen themselves, at the conclusion of a training course, ask for some continuation work — a round table conference, foremen's board, production club, or some other such organization—to keep up the self-improvement and plant improvement begun in the course.

When the story of these direct reactions from foremen training are known, it is no wonder that increased efficiency is the practical result realized in those plants that have made the most of the training. The records of reduced spoilage, reduced idle time, added economies, and increased output are but normal effects of the new attitude toward his job and surer grasp of production methods that even the average foreman gets from a training in fundamentals.

Use of Motor Vehicles in Algeria

The total number of motor vehicles in Algeria, including automobiles and trucks, is about 13,000. Passenger automobiles, now mostly French, are becoming popular among all classes, but especially among the European farmers here. When colonists can afford to they purchase passenger cars for bringing children to schools in cities and towns, and especially for making quick business trips to the principal ports, where their wines and cereals are exported.

The most common form of motor vehicle used in Algeria for general transportation is the autobus. This type, usually French, is rapidly superseding the railroad for short distance trips.

Motor vehicle travel, more than other forms of transportation, has been greatly increased through the influence of the Algerian Federation of Syndicate d'Initiative. This federation is composed of many local organizations, established to assist travelers by improving roads, hotel service, etc. The federation receives aid from a bureau operated by the Algerian government general.

The motor-vehicle market will doubtless continue to interest American exporters, but they must make greater efforts than in the past to obtain an important share of the automobile trade.

Automotive Developments in Great Britain

Several producers of high-powered cars in Great Britain are announcing 1923 models of lighter and lower-powered types to sell at a price considerably below that of their larger cars, in order to meet the popular demand for small economical vehicles. The overhead valve gear is gaining in popularity as a requisite for increased efficiency and silence in running. There is an increasing demand for spare tire covers of a waterproof nature, padlocking devices, and anti-splash mud-guards.

Second Annual Body Builders Show

Elaborate preparations are being made to make the Second Annual Body Builders Show in New York a thoroughly representative exhibit. This exposition will be held the week of Jan. 8 to 13 in the Twelfth Regiment Armory. This is the same week as the National Automobile Show in Grand Central Palace.

During this week, the Automobile Body Builders Association will hold its annual convention in conjunction with the Auto Body Show. This association includes in its membership and associate membership the leading manufacturers of bodies, body materials and parts therefor. Under the leadership of its president, John Graham, it has developed into a well knit, strong organization, and is becoming more of a factor in the industry each season.

A large number of the representative American automobile body builders have engaged space in the show. Realizing that the great majority of prominent automobile men are in New York City during that period, exhibitors see the value of putting automobile bodies and parts before the great number of visitors.

Applications for space are being received daily at headquarters of the exposition, 1819 Broadway, New York, and as the Body Builders' Association in itself numbers 125 members and associate members, it is believed that all of the floor space will be spoken for long before the opening date.

The purpose of this show is to educate and unify the interests connected with motor car body building; to help to maintain the industry in its rightful position in the automotive field and to show to the public the merits of body materials and parts.

Both passenger bodies and those for commercial vehicles will be displayed in profusion. The former include not only exclusive, ultra fashionable custom bodies, but standard equipment as well. The increasing popularity of the enclosed cars has resulted in many improvements in construction and design and the very latest of these will be offered.

Latest ideas in body painting and trimming will be featured, marked advances having been made along this line in the past couple of months.

Commercial bodies will show a wider variety of adaptability than ever before and especially interesting to many will be the offerings in motor bus bodies. The increase in the number of motor bus lines throughout the country is responsible for many of these new types.

Small Cars Preferred in Havana

Motor vehicles with a short wheelbase are much preferred in Havana because of the narrowness of the streets. Cars with a wheel base of 140 in. can not be operated in some of the business sections of the city.

Imports during 1919 amounted to 3,936 passenger cars and trucks—mostly from the United States. During the first half of 1920, 3,405 passenger cars and trucks were imported, of which 3,347 were American makes. Although statistics have not yet been compiled for importations since June 30, 1920, it is estimated that the imports for the entire year 1920 totaled about 7,000 cars and trucks. Only about 1,500 passenger cars were imported during 1921, although imports, especially in the smaller models, have been increasing since the beginning of 1922.

Diesel Engines for Motor Vehicles

This Efficient Prime Mover Has Been So Modified That it is Now Available in Sizes and Weights Suitable for Motor Vehicle Uses.

(Continued from October Issue)

This Steinbeker system brings up the general subject of fuel injection as compared with normal automotive carburetion, and especially the subject of spraying into the cylinders oil fuel. In any such system of oil spraying, there must be a means of spraying the oil into the charge of dense air—air of a density up to 30 or 40 atmospheres; means of arranging to get the injected fuel in contact with as much of that air as possible, and means of preventing at any point any considerable amount of fuel that cannot reach air, because in that case there will be carbon deposited and smoke produced, which will choke up the engine in time.

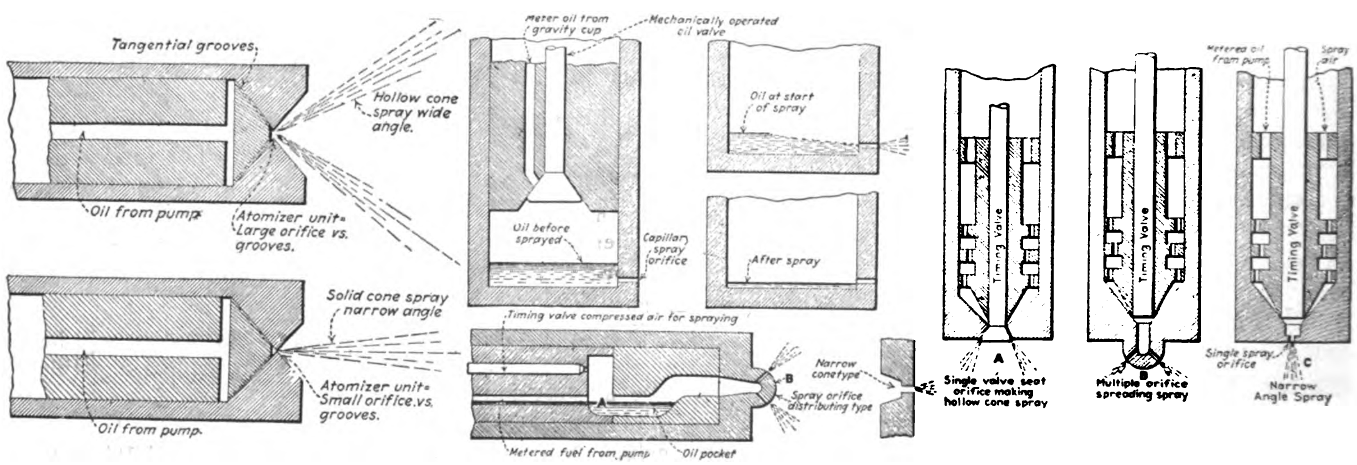
The means of carrying out the operations that are peculiar to the injection engine are divisable, functionally considered, into two classes. The air must always be compressed. It may be compressed to ignition temperature and higher, so that the fuel as injected into it ignites immediately and burns as fast as it gets in, the rate of combustion being the rate of injection and being controlled by mechanical means. On the other hand, it may be compressed not to ignition, but to something less than ignition temperature, and then the fuel injected suddenly, to burn as nearly instantaneously as may be. That gives us two classes of injection engines, giving characteristic indicator diagrams.

The first one carries the air to a high compression pressure, so as to have it not only as hot as the ignition temperature, but something higher. This would give a combustion at substantially constant pressure, but if combustion is carried out imperfectly or deranged as to timing of injection or combustion, explosive shock might occur or slow burning.

Each type is justifiable on the grounds of efficiency, power and practicability, so that the real problem boils down to one of mechanical questions of relative cost, reliability, foolproofness and adaptability to service conditions. The two are related in this simple manner as to efficiency. If the compression of the second with explosive-type combustion is about half the compression of the first burning the fuel at substantially constant pressure, their efficiencies are substantially the same. In the second case, if an explosive mixture is to be made, compression temperature must be kept a certain number of degrees (usually 100 deg. F.) below the ignition temperature of the fuel—this for fuel oil being about 1,070 deg. F., and with initial temperature of 300 deg., 150 lb. final compression must be considerably above the ignition point. For solid-injection sprays it is generally assumed that 200 deg. margin is safe and for air spraying 400 deg. For the latter case a compression of 450 lb. is pretty generally adopted and this will be secured with a little over 250 deg. initial temperature with kerosene and a little less than 250 deg. with fuel oil. Solid-injection ignition may be produced with equal reliability with less compression or with lower initial temperature, or both.

Mechanical Problems

The first mechanical phoblem in connection with the injection engine is the problem of making the spray, and one might say, in a way, that the building of the engine begins with the forming of a chamber around a spray. The simplest way of making a spray nozzle, introduced by the first successful commercial engine which was brought here from England, the Hornsby-Ackroyd engine, was drilling a hole in a plate. It was so designed as to deliver a jet of oil unbroken, and with kerosene the jet looked like nothing so much as a silver wire. It didn't make any spray, but by placing a plate in line with it so the jet could strike the wall, a spray was formed by splashing. That is the simpiest kind of spray ever made and more semi-Diesel engines are operating with such an elementary spray today than one might suspect. If the hole is reduced in size or if supplied with oil under much higher pressure, the oil will move more slowly on the sides and finally the entire jet will expand into a fine mist. If directed up into the air, such a spray would float the length of the room and look much like smoke.



Figs. 3 to 6. Some of the types of fuel injection now in current us e in Diesel engines. Fig. 3 (at left) Hollow and solid spray nozzles. Fig. 4 (upper center) Cup design of spray nozzles. Fig. 5 (lower c enter) Open spray nozzles. Fig. 6 (at right) Closed spray nozzles.

The essential characteristic of such a spray is strong penetration power. That is important on account of the great density of the air, but in order that such a spray shall be able to reach all the air, the air should be arranged more or less in a narrow conical tube around the spray, but this is not ordinarily convenient. What is necessary, is some means of spreading. This can be secured by multiple holes. Spread can be secured from a single spray orifice by giving the oil back of the orifice a rotary motion just as in the mechanical-atomizer oil burner is developed for the navy (Fig. 3a). Here, by locating oil grooves to deliver tangentially into a smaller chamber, the oil in the chamber will have a rotary motion and so also will the oil issuing from the end of the orifice at the outlet from the chamber. If the orifice has an area many times greater than the area through these grooves, there will be no residual pressure in the chamber, and in this case oil will issue in a hollow cone form, due to a pure centrifugal whirl.

The spray will have a good and uniform spread with little or no penetration. If, however, the orifice is narrowed down so that it is smaller than the grooves in area, there will be residual pressure in the whirl chamber, producing axial velocity also, and the cone spray becomes narrower and solid. The spray will then have less spread and more penetration. This indicates that by comparatively simple design means the shape, the spread, the penetration and the fineness of a spray can be controlled within limits. In addition to this method of solid-injection spraying, which has some design features and is not a matter of pure haphazard invention, there is the air-spray system.

Simplest Form of Spray

The air spray in its simplest form is secured as in Fig. 3b. This is a cup with liquid fuel in the bottom, air above the fuel and a small hole in the side at or below the oil level. As the air escapes through the hole, there is a first depression of the liquid right at that point and the liquid is carried to the orifice by the air flow across its surface and blown out, being sprayed by the higher velocity of the air. The quiet pool of oil has its surface disturbed by the air flow, friction carrying the oil gradually to the spray orifice. Such a spray is fine and has good penetration but not much spread.

A modification, giving somewhat better control, is shown in Fig. 3c, which has a depression in the passageway at A, in which the fuel is deposited as a pool. The air in motion will tear the liquid from the surface, and this may be delivered to the cylinder in a narrow cone spray through a contracted orifice or through multiple orifices as at B, to get an adequate spread. This form is the so-called "open air spray" of the Diesel engine.

Closed Air Spray Types

Next, there is the so-called "closed air-spray valve," in which a valve seats on the outlet of a passage, as in Fig. 3d, separating the cavity from the cylinder. The oil is delivered by a pump into the passage and spreads out on plates that are usually arranged with holes or grooves or slots in them so as to offer a large amount of surface to be wetted by the oil. The air, which starts to flow as soon as the spray valve is opened by a cam, tears the oil off gradually and delivers it as a spray through a single or multiple orifice as at B and C. Such a spray has a narrow angle, strong penetration and little spread except as may result from impact and rebounding. This is the most common air spray of the Diesel engine. To secure more spread directly, the valve can be reversed in seating, as in A, whereupon it will spray just the same, except that the angle of the spray is now widened, and it is a hollow cone instead of a solid cone, but with strong penetration.

For any given form of spray, air or solid, there must be a suitable combustion-chamber form, or for any given combustion-chamber form there must be selected a spray of suitable shape or energy to best reach all the air, with always the possibility of setting up turbulence or internal air currents as a corrective means.

Air Injection Diesels

The first class of engines to be noted under the injection class is the one that is most successfully used commercially —the air-injection Diesel engine. Such engines are normally rated at 70 lb. brake means effective pressure, but are capable of producing over 100 lb. if the metal can stand the intense heating. A fuel consumption of from 0.4 to 0.45 lb. per b.hp. per hour is standard. They are built in all sizes up to about 36 in. in diameter, depending on speed and mean pressure. The size is limited by the same internal heating conditions with tendency to crack the metal described as constituting the limit for large gas engines. The air-compression Diesel engine is in successful use for both stationary and marine purposes and has brought the internal-combustion engine into real competition with steam at sea, a matter of real importance which will be passed over as history.

Their Limitations

Certain limitations of the air-injection Diesel engine make it unsuitable for the problem just mentioned—the problem of the development of a substitute for the gasoline engine. It cannot be made to work in cylinders of small size without abnormally high compression, because of the cooling conditions that exist during compression, and in the size of cylinders that are just about its practical limit of smallness it is too expensive and too complicated. The control of the air spray is peculiarly delicate. The air for it must be provided by an attached air compressor, and it requires a pressure never less than 600 and often 1,200 to 1,500 lb. per sq. in. Such a compressor, small enough for the purpose of an automobile, is a mechanical absurdity. The air-injection Diesel, then, has earned for itself a place, but that place does not fill the entire field of possibility of the injection oil engine. The particular field to which it is not at all adapted, is the small cylinder high-speed engine and that, in the internal-combustion market, is the biggest field of all. So it is clear why the problem of developing the small, and especially the high-speed injection oil engine, is a real problem and a modern problem—a problem of the present day, on which everybody is working more or less actively or is at least thinking about it.

How About the Small Diesel?

To approach the problem of the small injection engine, what is available as a starting point? The nearest thing is a type of engine that has been on the market for some time and that is commonly known as semi-Diesel. This engine has a feature particularly attractive in the small-engine field—the feature of operating with socalled "solid injection or airless spray," eliminating the air compressor and the delicacy of adjustment of the air spray-valve system. It is simple, but in operativeness is not as perfect as the air-injection Diesel and is proverbially dirty-smoky, a condition that seems to be essential to the mode of operation. It has other peculiar characteristics that do not en-

(Continued on Page Twenty-Nine)

The Important Body Dimensions

Proper Sizes for Seat Lengths, Adequate Knee and Leg Room, Other Heights and Widths, from a British Body Builders' Standpoint.

BODIES are becoming of greater and greater importance, now that the mechanical portion of the motor car is so well advanced. This renders the work of the body builder of much greater import than was the case a few years ago. He must choose his body sizes and dimensions with extreme care, for a distinct lack in any one of these may practically put the car maker out of business. Considering this, it is important to examine the ideas of our friends across the seas.

The comfort in any type of motor body depends on the dimensions of the seats. The height of the seat from the floor, whether it is raked or framed in horizontally, the relationship of other seats and body partitions all have to be taken into consideration, while if it is a driving seat, then the distance from the steering wheel and control must be carefully studied.

The Length of the Seat

A seat for one person should not be less than 16 in. long. Few seats are made to accommodate one person only, so that this size has usually to be borne in mind when planning out seats for two or more persons. In private car work minimum dimensions will occasionally be adopted for the length of the dickey seat, or when arranging the seating plan of a public service vehicle of any kind. As a matter of fact, it would be unusual to allow less than 20 in. per person when designing a seat for two in most styles of open and closed bodies, this length being reckoned in the bare wood, so that the least possible dimensions for all practical purposes in order to ensure comfort may be stated as 18 in. when the body has been trimmed. In looking over the seating plans of various kinds of bodies, it is noted that the length of the finished seat is as follows:

		Inches		Inches
Two seater	front seat	42	per passenger	21
Touring phaeton	front seat	39	"	19½
ditto	hind seat	41½	"	20¾
Touring phaeton	front seat	39	"	19½
(seven seater)	extra seats (ea.)	17	"	17
ditto	hind seat	41½	"	20¾
Touring phaeton	front seat	41	"	20½
ditto	hind seat	43	"	21½
Touring phaeton	front seat	42	"	21
(seven seater)	extra seats (ea.)	15	"	15
ditto	hind seat	46	"	23
Coupe (two seater) ...	front seat	45	"	22½
Coupe (four seater) ...	front seat	43	"	21½
ditto	hind seat	45½	"	22¾
Limousine	front seat	40	"	20
ditto	hind seat	43	"	21½
Limousine	front seat	42	"	21
(seven seater)	extra seats (ea.)	15	"	15
ditto	hind seat	46	"	23
Limousine landaulette .	front seat	40	"	20
ditto	hind seat	43	"	21½

The length of the hind seat, although it may be ostensibly designed to carry two persons, may be made actually as wide as the wheel-track will allow. A body which measures 46 in. between the side squabs on the hind seat would probably have been ordered as "to seat three in cases of emergency.' It is seldom that even a 4 ft. 8 in. track allows of an inside measurement greater than 4 ft., since the present style of body work necessitates the cushions being arranged low in the body.

The width of the front seat is controlled, apart from space considerations, by the general design of the body. If the brake lever is outside the panels, and the speed lever inside, then the width at this part of the body will be definitely decided by the position of the gate of the change speed, while, if necessary, a little deviation is possible, by setting the levers in or out. If both levers are inside the body, as is usual nowadays, then the width of the body must be greater than the width over the levers, less any amount they may be set in, but adding at least 2 in. hand clearance for gripping the outer lever. The width of this seat is also determined by the amount of side sweep given to the body. From the practical point of view a seat may be narrower at the front than at the back, but this is seldom possible with a flush-sided body, although it can easily be arranged with a seat having angular back corners.

When designing the driver's seat of a lorry or box van, little attention is paid to actual length of seat required, but rather to the general proportions of the body. A large lorry—say a 3½ tonner—often has a cab 5 ft. 6 in. wide, large enough to carry three persons easily, but which will be occupied by the driver only on most occasions.

The Width of the Seat

The size of the seat from front to back varies according to the degree of comfort which is aimed at by the constructor of the body. It should not be less than 16 in. under any circumstances. This diemnsion may also be reckoned as the minimum from the back of the steering wheel to the face of the back rest. The actual dimension on the top of the cushion of an average private car, whether it be of the open or closed type, will be about 20 in. This will mean that the seatboard is from 2 in. to 3 in. wider, owing to the thickness of the necessary back framing, and sufficient allowance for the swell and fixing of the back squab. If a hind seat is an inch or two less in width than the above, this will be owing to the presence of extra seats in the body or compact design. Even in a luxurious body, the seat immediately behind the steering wheel will only be about 18 in. wide, probably less if the driver is of slight build, in order that he may have proper support from the back squab when using the pedals. If the front seats are dodged then the nondriving seat may be increased in width as desired. Extra seats, especially those which fold up, and therefore have to be made as compactly as possible, may be as small as 15½ in. wide, and seldom exceed 17 in. In addition to the width of the seat, the sail out of the back rest or squab has to be added, which will not be less than 5 in., or in the case of many driving seats, the thickness of the back rest, which will not be less than 1½ in.

Knee Room

Knee room is the horizontal distance allowed from the front edge of the seat measuring forwards. In many private bodies there is sufficient space in front of the hind seat for this dimension to be ignored, but if extra seats are fitted, or the body is compactly arranged, then care must be taken to see that there is sufficient room in this direction. When sitting in a normal upright position a passenger requires at least 11 in. beyond the front edge of the seat. This may be regarded as a minimum when setting out a pair of extra seats in a limousine or landau-

lette which face forwards, and will be reckoned as either from the front of the extra seat and the lining boards, or from the front of the main seat to the back of the extra seat. As knee room is a continuation of the seat width, it will often be convenient to add the two together, so that if the width of the seat is decreased the knee room may be proportionately increased, but not vice versa. In a medium-sized limousine, which is large enough to take two extra seats facing forward, the combined knee and seat room of the back seat will be about 31½ in., and that of the extra seats 27½ in. The knee room between the front edges of vis-a-vis seats, as used in a wagonette or omnibus, should be greater than twice the knee room for one seat, so that there is room for the feet. From 24 in. to 28 in. is an average measurement for the knee room with opposing seats, but these dimensions should be exceeded if a comfortable gangway is to be considered, as in a public service vehicle. In modern electric railway rolling stock there is often 4 ft. between the front edges of the seats, but this is, of course, impossible within the limits of a road vehicle.

Leg Room

Leg room is the diagonal measurement from the front edge of the seat to the toe line on the floor. When seated in an upright position, and the top of the cushion is not less than 17 in. vertically from the floor, the leg room should never be less than 21 in., while if the seat is well raked and low, then the leg room must be proportionately increased, allowing about 1½ in. more leg room for every inch less in height of the seat. Leg room may often be greater than at first appears, when it is possible for the feet to be placed underneath a seat in front, while in some bodies it is possible to increase the leg room of a folding seat by having a space provided at the bottom of the front lining boards. Leg room may also be defined as the diagonal measurement from the back of the seat to the toe line on the floor, in which case it should not be less than 35 in. The leg room of a driving seat must be arranged in accordance with position of the pedals.

The Height of the Seat

For public service work, or if the passenger in a private car does not wish to lounge, from 17 in. to 19 in. is the normal height of the top of the cushion from the floor in front, with a pitch of about an inch to the rear, so that the passenger uses the support of the back rest or squab without effort. For private car work the height of the seat is usually less, sometimes as low as 9 in. in front, but on an average this dimension will be from 15 in. to 17 in., with 2 in. rake from front to back. The height of the driving seat is restricted owing to the steering wheel, since there must be sufficient clearance between the underside of the wheel and the top of the cushion for the thighs. This must not be less than 8 in. measured vertically. The height of a driving seat may also be determined by the presence of a tank under it. Sometimes it is possible to lower the tank an inch or two or redesign it more compactly or a compromise may be effected by allowing the filler to project through the seatboard and slightly into the undersurface of the cushion.

Head Room

This dimension may be taken from the top of the seat to under the highest point of the roof or between this point and the top of the cushion, while some prefer to take it from the floor. The amount of head room given depends on the style of body. In an omnibus head room must be sufficient for a person of average height to stand with his hat on, and will not be less than 6 ft., since the passenger may have to walk several steps before gaining his seat. In a private car body head room is reckoned as the height necessary above the cushion for a seated passenger, since the crouching attitude necessary for entering or leaving the vehicle has only to be maintained for a moment or two. Also, a large public service vehicle, extra head room also means better ventilation, but if overall height has to be taken into consideration, then the head room need only be given above the gangway, while it may be restricted immediately above the seats. The tendency in private car design is for the body to be made to look as low as possible. This is achieved by first placing the seats as near the floor as possible and then arranging for a minimum of head room, whether it be a car with a cape hood or one with a fixed roof. The head room, however it may be expressed, in a private car must ultimately be decided by the height of the top of the cushion from the floor. Measuring from this point to under the crown of the hoopstick the head room should not be less than 3 ft. 3 in. If the compressed cushion is 4 in. thick and the seat is only 3 in. off the floor in front, it is possible to build a body of reasonable comfort which has a head room from floor to roof of only 3 ft. 10 in. Allowing for the thickness of the bottom frame below the floor and the substance of roof framing, it will be seen that the overall height of the modern, low rakish body may be within 4 ft. 2 in. from the top of the chassis. For a town carriage, where the seats are, say, 17½ in. from the floor, the overall height of the body will be about 12 in. more.

The Width of Doors

The width of the door of the sidelight coupe may be 36 in., while in a low-built sporting phaeton the owner may be content to climb over the side of the body and dispense with doors altogether. The minimum width of a doorway must be considered if it is a full one, that is, if it reaches to the cantrail. In this case it should not be less than 21 in., while if 24 in. is possible, the few extra inches will make a great difference in the comfort so obtained. Door width may have to be kept within limits owing to the proximity of the hind wheel, also, if front and main doors are unduly wide, they will increase the overall length of the body. In an open body the width of the doors is not of great importance, since only the legs have to pass through. Although a door opening of a torpedo phaeton may be, say 20 in. wide, measuring between the front edges of the standing pillars, this dimension will be increased about an inch owing to the bevel on the pillars. Also many doors, especially front ones, are finished with a rounded top corner where the door line runs across the scuttle dash. This will decrease the space available often as much as 3 in. Again, with any type of door, unless it open right back beyond a line at right angles to the side of the body, the thickness of the door, as well as its turnunder and the amount of opening allowed by the hinges or check strap, will decrease the amount of effective-door width. The value of a door is also determined by its relationship to the other parts of the body. A front door may encroach on the seat width. The door may be actually 21 in. wide, but the driving seat juts out across the doorway to the extent of, say, 7½ in., and there is an 1½ in. sweep at the scuttle corner, consequently only 12 in. is available for the passenger to get into the body. A

hind seat in most types of body may be framed clear of the door gangway—in fact, it many open cars it is several inches behind it; but the doorway may be impeded by the back of the front seat to the extent of 5 in. or 6 in. This is usually a rounded corner, and little discomfort is experienced so long as the door may be entered at an angle. The front doors of an open car are often less serviceable than they might be, owing to the desire on the part of the owner to have a body with a deep and imposing scuttle dash. The distance from the dash to the back of the steering wheel may be 32 in., but the actual entrance-way in, say, a two-seater car, with a steering wheel so placed, may be as little as 8 in., since 19 in. or so have been given up to the accommodation of the scuttle.

The wide doors which are adopted with the enclosed self-driving varieties of motor bodies are necessary owing to the general arrangement of the body. It is essential that the number of side pillars shall be as few as possible, especially if the head is made to fold; consequently a wide door will provide entrance to both front and hind seat, and in combination with a wide side light, a leather quarter and a deep scuttle dash make up the required overall length of the body.

The Height of the Body Side

This dimension is decided by the general proportions and style of an open body. The body side of a two seater, four, five, or seven seater, will be from 21 in. to 24 in. From the viewpoint of comfort the height should be related to the height of the cushion, since if the side is made too shallow, the passengers will have little side protection. In many bodies there is seldom more than 9 in. between the top of the cushion and the top of the side. In a closed body the height of the elbow line runs from 24 in. to 26 in., but it also has to be related to the total height of the body owing to the necessity for concealing the falling light when down.

In a limousine, landaulette, or coupe, the elbow line may be kept low by restricting the height of the light. This may be done by raising the line of the fence or dropping the level of the cantrail, a practice which is facilitated if the domed style of roof is adopted. The glass run of the side light, however, is often the deciding factor, since the glass rest has to be framed-in higher owing to the rise at the rear end of the chassis. If a side light has to be arranged above a wheel arch, then this will have a controlling effect on the setting out of the horizontal lines of the body.

The depth of back panels in open bodies is decided by the rise of elbow, which is usually from 5 in. to 7 in.

In commercial work the depth of the body side varies according to the style of body and the class of goods which is to be carried. A platform lorry will have the main sides projecting from 3 in. to 5 in. above the floor level. Lorries with open or closed sides have sides varying from 18 in. to 30 in. If the side exceeds 30 in. it is difficult to support it rigidly without making it unduly heavy, a matter which is just as important when the side is made to hinge or is detachable.

The thirty-seated char-a-banc usually has a 30 in. side, which is just the depth to give the long body good proportions. Also, as the seats are comparatively high, there will not be any too much protection for the passengers. If each seat is higher than the one in front of it, then the body side should also be increased in depth proportionately, which is best arranged by rising the elbow line with a sharp corner sweep at every alternate doorway.

From 28 in. to 30 in. is an average measurement for the depth of side of a large omnibus. By keeping to the larger dimension it is usually possible to hide the whole of the raised backs if garden seats are used.

Overall Widths

The widths of the modern flush-sided body are determined by the width of the dash, the position of the control levers and the wheeltrack. An open body mounted on, say, a 25 h.p. chassis of normal dimensions, will measure across the dash or front of the scuttle about 32 in., which may correspond with the width of the chassis frame at that part. The main portion of the body will have but little sidesweep, and the overall width of the body at the front of the driving and hind seat will measure from 4 ft. to 4 ft. 2 in. If the body is wider than this then it is probable that part of the hind cushion rests upon the curved sides of the wheelarch. In this case the body may have an overall width which is practically the same as the wheeltrack, that is, the square line of the turnunder passes through the center of the wheel when viewed from the rear.

Coupes may be made wider when necessary, since the greater part of the body may be designed independently of the wheels, a remark which applies to two-seaters as well.

The width on the bottom of the body varies according to the width on the elbow and the amount of turnunder given to the side panels. A turnunder of 7 in. a side is often given to a torpedo, which is lessened towards the front, since it has to be eliminated at the straight sides of the dash, although enough width should be maintained at the change-speed gate so that it can be included behind the body panelling. The turnunder in a closed carriage has to be kept within limits, since a large turnunder means heavy door framing in order that it may accommodate the straight glass run. The turnunder of limousines and laudaulettes should not exceed 5 in and not be less than 2 in.

Overall Lengths

When having to decide quickly as to whether a chassis will accommodate a certain style of body, it is often convenient to know within a few inches the overall length required for mounting the leading styles of modern motor bodies. The following dimensions are taken from the dashboard to the end of the frame:

	ft.	in.
Two seater, small scuttle, small hind boot	7	0
Two seater, large scuttle, large hand boot	8	0
Torpedo phaeton, small scuttle, close coupled	7	9
Torpedo phaeton, medium scuttle, good leg room	8	6
Torpedo phaeton, medium scuttle, extra seats	9	0
Small limousine, or landaulette	8	0
Medium limousine, or landaulette	8	6
Large limousine, or landaulette	9	0
Two-seater coupe, small scuttle, small hind boot	7	0
Two-seater coupe, small scuttle, small side light and dickey seat	8	6
Side light coupe, medium scuttle, five seater, close coupled	7	9
Large side light coupe, deep scuttle	8	6
Large side light coupe, seven seats	9	0
Taxicab	7	6

Design

Having a knowledge of the principles of construction and being provided with the most important dimensions on which the design of the principle types of motor bodies are based, it is then left to the imagination of the daughtsman concerned to lay out the new body.

Many variations in general effect are possible, since

(Continued on Page 29)

Fifty Years of Progress in the Varnish Industry

BY L. VALENTINE PULSIFER*

Fifty Years Ago a Chemist in a Varnish Plant Was Looked Upon as a Curiosity—Today Varnish Making is a Scientifically Organized Series of Operations

I feel as if I am present at a family gathering, even more so when I see we have with us a cousin from across the sea. My family has been connected with your industry through four generations. The first member was my grandfather's uncle, Mr. Lawson Valentine, who entered into the selling, in Boston, of wholesale and retail paints and varnishes for the ship chandlery business and coach business in 1832, and I believe that we were associated in starting this association, and we have always been its enthusiastic supporters. Perhaps we have grown away from each other in the last hurried years, but the C. B. N. A. is very close to our hearts and always has been.

The subject that I was going to talk on this morning (and this is not an address, but I am considering it a talk that I am having with all of you people in case you were visiting me in my laboratory) will deal a little with the progress of the varnish industry in the 50 years during which this association has been in existence. The varnish industry has changed in that time, like many others, into a more scientifically organized series of operations than was then thought either possible or desirable in any industry.

In fact, 50 years ago a chemist in a manufacturing plant was looked on as a sort of curiosity. But nowadays he is not only in the varnish industry, but in the vehicle industry, both horse-drawn and automobile, and is of assistance in what you might call "keeping the wheels on the track."

In the manufacture of materials which you use, a very limited class of materials comes into play. The varnishes and paints that you use are all, with the single exception of shellac, what are known as oil varnishes; and in those materials there are four classes of ingredients: First, the gums or rosins which give the varnish its brilliancy and hardness; next, the vegetable oils which impart to it its flowing qualities and its elasticity and durability; then the chemical dryers, manganese, cobalt, etc., which enable the varnish to absorb oxygen and dry; and finally the turpentine which is used as a dilutent to produce its viscosity to such an extent that it can be applied on the panel.

I have with me a few typical samples of the gum base materials which are used in making varnish, and they range from debar, which is a water-white material used in making white enamel, to Egyptian asphaltum, which is the base of the highest asphaltum varnish; then several samples of the so-called fossil gums which are either of historic or present value in the manufacture of varnish.

The first sample here is a so-called Zanzibar or Madagascar opal which 70 or a hundred years ago was the standard material used in the making of all varnishes of this type. Another sample here is the kouri gum, which today stands at the head of the list. One of its present competitors is the socalled Congo gum, which comes from the Congo region of Africa. These materials are all similar in their nature and the world apparently is full of them. When one runs out, a new deposit will be discovered somewhere else. I have talked with Mr. V. S. Holmes, who for many years before me was chief chemist of Valentine & Co., and heard of the horror with which the varnish industry saw the declining supplies of the socalled Zanzibar gum. There was a material which was coming in from New Zealand as ballast and selling at 2 or 3 cents a pound, and was looked on as a lifesaver. That is the kouri gum, which is the standard material in use today.

Value of Vegetable Oil

The backbone of the varnish business, however, is the vegetable oil, because in finishing the varnish the vegetable oils exceed in total percent the gum by two or three hundred percent. I have here a series of vials which show the history of linseed, from the original flaxseed from which it is crushed, up to the finished varnish, in the various processes through which it goes in a modern varnish plant.

This is the flaxseed with which you are all familiar, at least in poultice form. First comes the raw linseed oil. This has to be settled until the socalled "foots" have gone to the bottom of the tanks. Then the clear material is drawn off and we have here the raw linseed oil after it has been tanked. The physical impurities have separated and gone to the bottom and the oil is ready for the refining process next. Then comes the refining process, which, as you can see, removes some of the color and also removes some chemically combined impurities, which would make it impossible to properly heat treat the oil. The next process after the refining is the bleaching. This bleaching is carried out by heat alone. The use of chemical agents for the bleaching of oil interferes with its flowing qualities and some of the other desirable qualities, and in this case the oil is bleached by putting it in a varnish kettle and running it rapidly up to a temperature of between 560 and 600 deg. Fahrenheit.

Then there are a few more impurities which are removed by subsequently chilling that oil. It is then reduced to a temperature of about 20 deg. F. and a small amount further of the high boiling fats are thrown out and that makes the varnish more safe for shipment in cold weather. It is still advisable not to chill high-grade varnish, but the high-grade varnish of today is very different than what it was 50 years ago, before this process was introduced. Then comes the heat treating of the oil, which corresponds to the heat treating of steels, or something of that sort, and in that further heating a viscosity is given to the oil and it is rendered in the proper condition for use in making varnish. I have on my right the original raw oil ready for use in making varnish, and you can see the viscosity has greatly increased. The density of the oil has increased considerably more per gallon and the heat-treated oil of that sort yields a much better prod-

* Valentine & Co., New York. Address before the fiftieth anniversary of the Carriage Builders' National Association.

uct that the varnishes which are made with so-called brown oils, which are heated to a considerably less degree and air pumped through them. The brown oil process is considerably cheaper and involves no loss of material, but it yields a product which is likely to be dead and perish in bad weather.

Then, finally, comes the bottle showing the completed varnish, and that is the combination of these four ingredients: the gum base, the oil giving it flowing qualities and elasticity, the dryer giving the power to absorb oxygen, and the turpentine which reduces the consistency. It is lighter in body than the heavy oil and considerably heavier in body than the original before it has been treated.

That is a brief sketch of the processes through which the material goes, and of course these are tested in the laboratory at every stage of the game. After that, the material is turned over to your tender mercies and the success of the job depends not only on the character of the original material, but also on the skill and the engineering knowledge with which the material is used.

The New Method

We have changed in the last 50 or 100 years from a slow system of painting, in the old English type of painting with the lead and oil base, to a series of much more rapid operations; and in doing that, as in any change that is of a basic nature, we run into a good many snags and difficulties with respect to elasticity, etc., for the reason that the engineering of the job has not been properly understood. It is just as much an engineering proposition to build the right finish on a buggy body as it is to build a steel block.

Now, I have here a couple of charts which show the modern methods of painting an autoombile, reduced to an engineering blueprint, as you might call it. This was shown last winter to the automobile engineers, and they were much surprised that we could take a painting job and show it on a blue print. We start with an elastic primer and the length of these columns represents the relative elasticity of these coats and each column represents a different type of material. We build down through what is known as half-and-half, which formerly was known as the elastic rough stuff. That has still less elasticity to enable it to have the proper consistency for surfacing to the flat color which is a material of almost no elasticity. That represents the low point. Then we start up again, through the various color varnish coats which vary in elasticity with the amount of color which they contain, up to the final coat of finishing, which should have at least an elasticity as great as the original primer. This will give a system which will give safe results.

On the other hand, if the system, such as is shown on this other chart, is used, and such a system has been used in a good many cases with more or less fatal results, we get an elasticity curve somewhat like this (illustrating). This was a case in which they had in here a ground color of very great elasticity, much greater than the rough stuff, followed by color varnishes of less elasticity. The result was, we had an upset and the various coats under the stress of the weather didn't pull together.

I have got an illustration of that, showing exactly what happens when such a thing is done. Here is, perhaps, an exceedingly rough example of this difficulty. This is sawed off a buggy body. It shows a system which was designed about like that faulty one. The elastic coat in the middle has pulled the other on top of it all to pieces, with the result that the finishing coat has got the well-known alligator cracks we all try to avoid. I am going to pass it around.

To show how that can be produced by having too elastic a material underneath I have got a panel which looks like the first, and the result was produced in a different way. This is a piece of rubberized top material and that is a very elastic material, of course; more so even than any form of paint or varnish, and was given two coats of the most elastic black enamel it is possible to make, and yet we have just the same result as the other panel because the material underneath was too elastic for the material on top. Those two look almost the same. It is a demonstration that you must not have too much elasticity underneath.

Another thing which causes the difference in the durability of your finish is the material over which it is applied regardless of elasticity, and I have here two panels which show the difficulties we always experience with blues at times. Blue is a very chemically active material. The old finishing varnish, while it resists moisture as far as its own disintegration is concerned, is not waterproof in the sense it doesn't allow water to get to the color coats underneath. This entire panel was covered with three coats of blue color varnish and this side has a coat of clear rubbing, and the whole thing finished with the same varnish; and in looking at this, you will see how much better the finish has stood up over the side that had the clear rubbing between the last coat containing the blue and the finishing varnish. This shows the difference between the same varnish standing up over blue and over green.

These are a few of many interesting tests and samples that it is possible to show you, but as your president says, the time is short, and perhaps this sketch will be all that is desirable this morning.

I have here a sample of varnish, however, in a form which you probably are not accustomed to seeing it; you usually put it in a can. This is not to show a new method of selling or purchasing varnish. This shows you about how much material you have got on the finish of your job and what there is between the color coats and the weather to protect it.

This is a coat of a very elastic but hard drying varnish, which was produced by taking a piece of glazed paper, coating that with caramel, and varnishing that as if it were a panel. There are two coats, by the way. After the varnish is dry, the whole thing is soaked in water; the water goes through the paper and melts the sugar and you peel off your sheet of varnish. These two coats are probably about three one-thousandths of an inch in thickness, so that your ordinary coat of finishing varnish is only a little over a thousandth of an inch thick, and yet, considering the use it gets today, especially on the motor-driven vehicles, the way it stands up is really remarkable.

This is not as smooth as I would like to see it, because the sugar curled up underneath and has an enameled appearance on one side. Pass it around.

My time is up and I am going to steal another minute to say I hope to see you all here and join with Mr. Wilson in congratulating the organization in having such a large turnout, and I hope this 50th birthday anniversary of the C. B. N. A. is not only the 50th birthday, but a rebirth. I have a rather peculiar job in my organization.

I have charge of the manufacturing and also the advertising—rather a peculiar combination, but I can say with feeling and with knowledge that if you want to have your goods used you must tell people about them. I think the whole horse-drawn vehicle industry has to a certain extent been asleep at the switch and have let, as the president so pointedly remarked, the automobiles come in and steal your thunder.

In addition to being a varnish manufacturer, I am a farmer and really believe we have got more gasoline-driven vehicles on the farm than really is economical, and yet the whole trend of the times has been to sell the farmer gasoline-driven vehicles, and many are uneconomically used. This is a business that always belonged to our organization and there is no reason in the world why you cannot get it back, and I, for one, hope and feel that a little more life and pep put into the C. B. N. A. will result in more business for the entire organization.

Questions and Answers

Mr. Ahlbrand—Will you permit me to ask a few questions? Mr. Pulsifer, in showing this chart, you demonstrate the fact that we run from the primer to the flat color coating and then up to the finishing and varnish coating. If this coat were omitted entirely and a solid elastic coat put on there in the way of a solid rubbing varnish, would that help or detract from the wearing qualities of that? What effect would that have?

Mr. Pulsifer—If the materials such as you described had the proper elasticity—those materials above and below—the result obtained would be no better or worse. If the flat color should be a very porous material, the next coat of material should soak through it and bind it to the material underneath. It is merely the quickest and easiest way of getting a solid body. To get that you probably would have to use more coats than if you put on a material or japan color type because you would get most of those colors to cover solid in one or two coats and save on your rubbing varnish coats.

The logical system of automobile finishing consists of five different operations. You have your priming operation, which is necessary to prepare the surface for the subsequent coats; then your surfacing operation, which, because of metal bodies, can be cut to a minimum, as there is no reason why the metal itself should not get most of the surfacing. If you get your metal through smooth, you can eliminate a number of coats that are now used; then your color body, through your rubbing coats and finally your finishing. If it is desired the primer or the finish can be thin. The intermediate coats are merely to give you the character of finish you want and it is perfectly possible to eliminate the so-called japan color if there is no advantage gained, and not pile up an unnecessary number of rubbing varnish coats. If, however, you have to put on as many coats as you did before, to get the proper body, you have actually lost because you have a thicker surface there, and to get the proper covering and all things being equal, provided you have enough coats on there to protect the surface from the weather, or from the abuse that it gets, the thinner, the less disance between the primer and finishing, the better the job is going to stand up.

When the automobile first came in, they put on too many coats. The result was, they got these alligator cracks all through it. In all painting I think it is a cardinal point to get the desired result, both from texture and beauty of finish, with the fewest number of coats. Every unnecessary coat is a detriment in more ways than one.

The Important Body Dimensions

(Continued from Page 26)

there are many exterior features which may be arranged to suit individual taste without interfering unduly with the dimensions already set forth. The general proportions of the body, that is, the width of the doors in relation to the seat panels and scuttle, the depth of the body both above and below the elbow, the height of the body sides in comparison with that of the bonnet, and so on, may be varied almost indefinitely.

The molding display alone often influences the style of the body to a large extent. In a limousine the elbow molding may drop slowly or quickly from the top of the scuttle and then proceed in a straight line until it rises sharply or gradually at the rear. In another body it may rise sharply again immediately at the front of the driving seat, or this sharp corner may, in another body, be found immediately at the back of the hind standing pillar of the main door. Or, again, the molding on the top of the body side by the driving seat will run up the front standing pillar after curving round at the junction with the elbow.

At the present time molding display is but little used, and the general effect largely depends on good proportions and well-shaped contours.— Automobile & Carriage Builders' Journal (London).

Diesel Engines for Motor Vehicles

(Continued from Page Twenty-Three)

tirely commend it and prevent its general adoption, and that have prompted a large number of people in both America and Europe to address themselves to the problem of making a solid-injection engine that shall have better characteristics. The two engines first illustrated and described, would seem to be reasonably good attempts along these lines, and considered wholly from an automotive manufacturers' standpoint. As such, it is to be hoped that their testing and subsequent revision and modification will be rapid as well as along lines of mechanical efficiency since the Diesel form of power plant, more than any other would serve to solve for all time practically the fuel problem, using as it does the lowest grade of crude oil, distillate and similar liquid fuels, some of which are not usable otherwise.

Hardwood Manufacturers Institute Holding District Meetings

The fourth district meeting of the Hardwood Manufacturers Institute, for the purpose of providing mill instructions to bring about uniformity in the application of inspection rules, will be held at the National Park Hotel, Vicksburg, Miss., Dec. 12.

The results of meetings previously held were so satisfactory that it has been decided to hold a series of such meetings in different localities, the next one to be in Vicksburg, Miss.

A cordial invitation has been extended not alone to members but to all hardwood manufacturers in Mississippi, Tennessee, Louisiana, and Arkansas, to attend this meeting.

They have been urged to bring along their production superintendent and inspection foremen. The meeting will be conducted by John M. Pritchard.

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

Clarence A. Earl has resigned as president of Earl Motors, Inc., Jackson, Mich. **George C. Scobie** has been elected as his successor. Mr. Scobie has been identified with the company as vice president and treasurer. The change took effect as of Oct. 1. Earl, who formerly was executive vice president of the Willys-Overland, took charge of the old Briscoe plant at the request of the Chicago interests then in control, as successor to President Wardell. Earl is one of the most popular executives in the industry and his host of friends will await anxiously his announcement of future plans.

Frederic T. Wood has been elected president and general manager of the Fifth Avenue Coach Co. and the New York Transportation Co. to fill the vacancies caused by the resignation of President John A. Ritchie and Vice President and General Manager George A. Green, who have joined the Yellow Cab Manufacturing Co. of Chicago, as president and vice president and geenral manager, respectively. Wood will fill the dual role, while R. E. Fisher will continue as chief engineer.

William Gamble has been appointed purchasing agent for the Rock Island Plow Co., Rock Island, Ill. For 30 years, he has been a member of the Moline Plow Co., of Moline, Ill., for the past year or two being located at Poughkeepsie, N. Y. He will make his headquarters at Rock Island.

Charles B. Wilson, former vice president and general manager of the Willys-Overland Co. in Toledo, who resigned to make way for President John N. Willys to take charge of the plant, has gone to Pasadena to visit a brother before returning to his extensive interests in Pontiac, Mich.

Harold Hemenway, for many years prominent in the Moline factory district, but lately with the Peoria Malleable Iron Co., has returned to the Moline Foundry Co. as superintendent and director. The work of the superintendent has been in charge of S. S. Hoffman, president.

C. A. Crusoe, who has been director of purchases of the Fisher Body Co., Cleveland, has been transferred to Detroit, where he has become supervisor of purchases for the General Motors Division of the company. His office is in the General Motors building.

Nathaniel Leverone has resigned as secretary and treasurer of the Hill Pump Valve Co., Chicago, to become secretary of the Advance Lamp Works of that city. For a number of years Leverone has been a leader in the Automotive Equipment Association.

E. A. DeWaters, chief engineer of the Buick Motors Co., was a visitor at the recent automobile show at Paris, France. DeWaters, who is accompanied by Mrs. DeWaters, is making a study of the trend in automobile engineering and design.

Frank Woodworth of the Remy Electric Co., Anderson, Ind., has been appointed production manager of Fuller & Sons Mfg. Co. He succeeds William T. Clarke, who has severed his connections with the plant.

H. J. Edwards has been appointed second vice president and factory manager of the Cole Motor Car Co., Indianapolis. He has been connected with the automotive industry since 1898.

D. A. McConnell has resigned the presidency of the Klaxon Co. of Newark, N. J., effective Dec. 31, although his active connection with the company ceased Oct. 15.

W. W. Sayers of the Link-Belt Co. has been promoted to the position of chief engineer of the company's Philadelphia works and eastern operations.

Body Builders

Universal Body Corp., 230 E. Ohio street, Chicago, recently incorporated with $50,000 capital stock, has leased 24,000 sq. ft. of factory space in a building at Pershing road and S. State street and will manufacture automobile bodies of the closed type. It is probable that production will be limited to taxicab bodies until early next spring. All of the work will be done in the company's plant and not by contract. Additional metal-working and wood-working machinery, as well as special body equipment, is expected to be purchased within the next three months. J. L. Geier is president and W. H. Heggem secretary.

Edward G. Budd Mfg. Co., Hunting Park avenue and 25th street, Philadelphia, manufacturer of steel automobile bodies, has filed plans for two one-story additions. Other structures will be erected later, for which plans are being prepared by the Ballinger Co., 12th and Chestnut streets, architect and engineer. The company is arranging for an increase in capital from $8,750,000 to $14,498,300, a portion of the proceeds to be used for enlargements.

Phillips Body Co., a subsidiary of the Fisher Body Co., General Motors building, Detroit, has plans for new works at Ravenna, O., to include the remodeling of an existing structure and the erection of a one-story addition, 40 x 100 ft., estimated to cost $45,000. The Carter-Richards Co., 923 Illuminating building, Cleveland, is architect.

Chicago Avenue Commercial Auto Body & Wagon Works, Inc., 800 N. Albany avenue; capital $7,500; to manufacture and deal in motor vehicle bodies, wagons, etc., has been incorporated by Louis E. Levinson, L. Shirley Tark, Alice Johnson; correspondent, L. Shirley Tark, 56 W. Randolph street.

Giljack Auto Truck Body Co., Jackson, Wis., is a new $25,000 corporation organized by W. J. Gilbert, E. A. Prahl and P. J. Haynes to engage in the manufacture of special body equipment for commercial motor vehicles.

S. Kukielski, 431 Montgomery street, Jersey City, N. J., manufacturer of wagon parts, automobile bodies, etc., has had plans prepared for a new two-story works at 415-21 Montgomery street, to cost $53,000.

J. J. Walsh Co., 1540 Columbus avenue, Roxbury, Boston, truck bodies, has awarded a contract for the erection of a one-story, 72 x 122 ft. manufacturing unit on Columbus avenue and Center street.

Charles Sudrow, 1099 Genesee street, Buffalo, is planning for the construction of a one-story works at Genesee and Peterson streets to manufacture automobile and motor truck bodies.

Washington Auto Body & Wheel Co., 911 11th avenue, Seattle, has preliminary plans under way for a one-story addition. Lewis Williams heads the company.

William Benke, Newark, manufacturer of automobile bodies, has purchased the one-story building, 85 x 100 ft., at 343-49 Elizabeth avenue, for a new plant.

Monroe Body Co., Ludington, Mich., was destroyed by fire Nov. 14, with loss estimated at $150,000, including machinery. It is planned to rebuild.

National Auto Body Corp., Wilmington, Del., has been organized to manufacture automobile bodies. Capital $350,000.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

T. W. Warner Corp., Toledo, O., manufacturer of gears, has preliminary plans for enlargements in the plant of the New Process Gear Corp., Syracuse, N. Y., lately acquired in conjunction with W. C. Durant, head of the Durant Motors, Inc., 1819 Broadway, New York. The entire works, comprising more than nine acres of floor space on completion of expansion, will be used for gear production for the Durant and Star automobiles. T. W. Warner heads the company.

Durant Motors, New York, has awarded contract for the construction of an additional unit to the building program in Flint. The new structures are to be utilized to double the production of the Star car, and will be a duplicate of the plant being erected for the manufacture of the Flint Six, having a floor space of 516,000 sq. ft. May 1, 1923, is the date set for completion, and the Durant enterprises in Flint will then employ at least 8,000 men.

Chevrolet Motor Co., Detroit, will build a plant 300 x 600 ft., to be erected in Norwood, O., and a similar adjoining building will be erected by the Fisher Body Corp. While the purpose of the new structures has not been definitely announced, it is reported that they will be used for assembling the new air-cooled car soon to be put on the market by the General Motors Corp. The cost, with equipment, is estimated at $3,000,000.

Weidely Motors Co., Georgia and Shelby streets, Indianapolis, manufacturer of automobile engines, has plans for enlargements for the manufacture of six-cylinder motors. The present works have a capacity of about 1,000 motors of this type per month, practically all contracted for by the Auburn Automobile Co., Auburn, Ind. Bonds for $700,000 have recently been issued for general operations and expansion.

Stutz Motor Car Co. of America, Indianapolis, which recently passed into the control of Charles M. Schwab and associates, has purchased the property of the Empire Motor Co., Indianapolis, and will erect a number of additional buildings for the production of a new six-cylinder car. The present plant of the company will be devoted exclusively to the production of four-cylinder cars.

Ogren Motor Car Co., 629-698 National avenue, Milwaukee, manufacturer of passenger automobiles, has increased its authorized capitalization from $500,000 to $1,000,000 to finance the enlargement of the factory, purchase of additional equipment and generally accommodate the growth of the business. Details of the program have not yet been made public.

Chevrolet Motor Co., General Motors building, Detroit, has plans nearing completion for a one-story works at Toledo, O., 90 x 450 ft., for the manufacture of gears and transmission equipment; one-story heat-treating shop, 100 x 120 ft., and one-story power house, 60 x 90 ft. Albert Kahn, 1000 Marquette building, Detroit, is architect.

Ford Motor Co., Detroit, has awarded contract for a one-story assembling plant, 500 x 1400 ft., on property recently purchased at 180th street and Torrence avenue, Chicago. The new works will be equipped for a capacity of 450 assembled cars per day, and will be increased by the erection of additional stories later.

Steinmetz Electric Motor Car Corp., Kate avenue and the Western Maryland Railway, Baltimore, is considering plans for a new plant at Syracuse, N. Y., to manufacture electrically-operated motor trucks. Dr. Charles P. Steinmetz, chief engineer General Electric Co., Schenectady, N. Y., heads the company.

Doble Steam Motors Co., 714 Harrison street, San Francisco, manufacturer of steam-operated automobiles, will soon take bids for the erection of a new plant at Atascadero, Cal., to consist of a main one and one-half story works, 100 x 500 ft., estimated to cost approximately $100,000, including machinery.

Studebaker Corp., South Bend, Ind., manufacturer of automobiles, has awarded a contract to the J. G. Christman Co., South Bend, for the erection of two additional floors on the present two-story plant structure known as building 79. Work will be commenced at once.

Double Drive Truck Co., 4826 W. Kinzie street, Chicago, manufacturer of motor trucks, is completing the removal of its plant to Benton Harbor, Mich., where property was recently acquired. Additional equipment will be installed for increased output.

Duesenberg Co., South Harding street, Indianapolis, is said to be arranging a list of equipment for installation in its new one-story plant addition, 60 x 200 ft., on which construction was recently commenced, to be used for motor assembling.

Lycoming Motors Corp., Williamsport, Pa., has perfected a new automobile motor and will make enlargements in its plant to develop an output of about 125 motors per day. The present working force of 700 will be increased.

Joyce Mfg. Co., 2970 Jefferson avenue, Detroit, recently organized with a capital of $500,000, has leased a building for the establishment of a plant to manufacture automobile equipment.

Paige-Detroit Motor Car Co., Detroit, has taken over the former plant of the Hinkley Motors Corp., West Ford street, and will use the structure exclusively for assembling.

Ford Motor Co., 2060 E. Seventh street, Los Angeles, has preliminary plans in progress for a one and two-story addition to its assembling plant, 150 x 350 ft.

Hialeah (Fla.) Coach Co. has tentative plans under way for the erection of a new plant for the manufacture of six-wheel coaches and other vehicles and parts.

H. H. Franklin Co., Syracuse, N. Y., it is reported, has postponed the erection of its plant for the manufacture of four-cylinder air-cooled motor cars.

Electric Auto Lite Co., Toledo, is enlarging its Fostoria plant by rebuilding the plant formerly occupied by the Allen Motor Co.

Ford Motor Co., Highland Park, Mich., will take bids at once for a one-story and basement addition on Brush street, 100 x 237 ft.

Anderson Motor Co., Rock Hills, S. C., manufacturer of automobiles, has preliminary plans for an addition to its plant.

Rickenbacker Motor Co., 4815 Cabot avenue, Detroit, has preliminary plans in progress for a one-story addition.

Cameron Motor Co., Cleveland, Ont., is contemplating the erection of a plant at Niagara Falls, Ont.

About 199 thousand passenger automobiles were produced in 1911; there were over two billion gallons of liquor drunk. In 1920 there was nearly two million cars made and only 300 million gallons of liquors gotten away with. This is not anti propaganda but one reason why manufacturing heads are strong for auto and the pocket, with a vers libre spirit on the side for personal consideration.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

3704—Bicycles and bicycle accessories, including tires—China. Purchase desired. Quotations, c.i.f. Antung. Catalogues and prices are requested. Terms, cash.

3711—Thermostatic regulators—Canada. Purchase desired. Quotations, f.o.b. shipping point. Payment, cash.

3736—Artificial leather—South Africa. Agency desired.

3792—Automobiles and tractors—Mexico. Purchase desired. Correspondence, Spanish.

3794—Motor cars of the $400 class—Switzerland. Agency desired. Quotations, f.o.b. Geneva.

3918—Solid and cushion carriage tires and carriage mats—Canada. Agency desired.

3807—Vanadium steel, rollers and ball bearings, gasoline feeders, speedometers for automobiles and motor cycles, brake bands, and lubricating oils—Italy. Purchase and agency desired. Quotations, c.i.f. Genoa preferably.

3867—Small steam automobile—Denmark. Agency desired.

3837—Motor cars and accessories of medium quality—France. Agency desired. Quotations, c.i.f. French Port. Correspondence, French or Spanish.

3891—A low-priced motor car and automobile novelties

3993—Automobiles and motor cycles—Italy. Agency desired. Correspondence, Italian.

and accessories—Norway. Agency desired.

4010—Motor fire-fighting apparatus and supplementary fire-fighting equipment—India. Purchase desired. Quotations, c.i.f. Karachi. Terms, cash upon delivery. Illustrations and price lists are requested.

4039—Trucks, especially those suitable for passenger transportation, and trailers, motorcycles, bicycles, and disk wheels—South Africa. Agencies desired. Payment to be arranged by letter of credit or through commission houses in New York.

4085—Automobiles and accessories, typewriters, office supplies, and new inventions and specialties relating to automobiles—Spain. Purchase or agency. Quotations c.i.f. Malaga. Payment to be made against documents.

4157—Automobile tires—Norway. Agency desired.

4174—Five passenger motor cars, with light and powerful engines for easy hill climbing—Syria. Purchase and agency desired. Quotations, f.o.b. New York. Payment by confirmed credit in New York.

4181—Automobiles, marine engines, etc.—Sweden. Purchase desired.

4207—Automobile bus for suburban use for 20 to 25 passengers—Canada. Purchase desired. Quotations, f.o.b. shipping port. Terms: Cash against documents.

4211—Automobile accessories of all kinds—Switzerland. Quotations, f.o.b. New York. Terms: Cash with order. Correspondence, German or French.

4214—Automobile parts and accessories—Norway. Purchase and agency desired. Quotations, c.i.f. Christiania. Payment to be arranged through bank in New York.

4225—Automobile camping outfits and automobile trailers—Norway. Purchase desired. Quotations f.o.b. New York.

4229—Motor cars, tires and accessories—Ireland. Agency desired. Quotations, f.o.b. New York.

4240—Motor cars, motor trucks, motor cycles and tires and accessories in the automotive line—Germany. Purchase and agency desired. Quotations c.i.f. German port.

4267—Automobiles selling for $450 to $2,500, light tractors, motor cycles, bicycles, automobile bodies, wind shields, rubber pads, telephone tubes, horns, lamps, patent fasteners, top covers, ball bearings, and vulcanizing outfits and supplies—Hungary. Agency desired. Quotations, c.i.f. Hungary.

4278—Batteries and magnetos for motor cars, lighting, etc.—South Africa. Purchase and agency desired. Quotations, f.o.b. New York. Payment to be made in New York.

4297—Specialties in automobile accessories, particularly those sold by the hardware trade—Cuba. Purchase desired. Quotations, f.o.b. New York.

4318—Automobile and motor cycle accessories and novelties—Victoria, Australia. Purchase and agency desired. Payment, cash in New York.

4320—Motor busses—Sweden. Agency desired and also the purchase of all kinds of motor supplies.

4321—Automobiles, motor cycles, accessories, benzine, tires, vulcanizing and retreading outfits, air compressors, etc.—Hungary. Purchase and agency desired. Quotations, c.i.f. Hungarian port. Correspondence, German, French or Hungarian.

4350—Agricultural machines, tractors, automobiles (lighter and cheaper cars), motor trucks (1½ to 3 tons), and motors of various descriptions—Baltic Provinces. Purchase and agency desired. Quotations, c.i.f. Baltic port. Correspondence, German.

4352—Motor cars, motor cycles, and accessories, spares, and tools of every description—India. Purchase and agency desired. Quotations, f.o.b. New York.

4365—Rubber tires, electric light bulbs, and all accessories for low-priced automobiles, and lubricating oil—Chile. Purchase desired. Quotations, c.i.f. Chilean port. Terms: Cash against documents. Correspondence, Spanish.

4373—Accessories for low and medium priced automobiles—Palestine. Purchase and agency desired. Quotations, c.i.f. Jaffa.

4397—Motor cars of the $400 grade—Switzerland. Agency desired. Quotations, f.o.b. American port.

4398—Automobile accessories and novelties, and any lines in connection with the automobile trade, except tires—Australia. Agency desired.

4390—Paints and varnishes, chemicals, lubricating oils and greases, and technical articles applying to metallurgic, textile, and automobile industries—Italy. Agency desired. Quotations, c.i.f. Genoa. Correspondence, Italian.

4402—Automobiles and accessories—India. Purchase and agency desired. Quotations, c.i.f. Madras. Terms: Cash against documents.

4416—Motor car fittings and accessories, leather and cloth for mtor cars—Uruguay. Agencies desired. Quotations, c.i.f. Uruguayan port.

The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1, Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3, Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. LXIV. No. 9 DECEMBER, 1922 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3.

The Automotive Manufacturer

A Consolidation of The Hub and Automotive Engineering

Vol. LXIV. NEW YORK, DECEMBER, 1922 No. 9

Sending the Highway to School

BY GEORGE M. GRAHAM*

Solution of Highway Problems Depends Wholly on Education — Transportation Lowers Costs of Necessities and Life's Enjoyments—Highways Are Necessary for Motor Transportation

HAPPILY methods and a better understanding have so changed conditions that the taxpayer assessed for his share of a mile of concrete highway does not feel that highways transport and "hold-up" go together. On the contrary it is now admitted that work of this kind benefits all without discriminating against anyone. The application of the ordered processes of education to highway problems is not admitted to be of infinite importance. It means almost incredibly expanded possibilities.

A stretch of dual type pavement on the Buffalo-Rochester road, Genesee county, N. Y.

One of the Suffolk county (L. I.) roads between Cold Spring Harbor and Fort Salonga.

Nothing Education Cannot Conquer

The solution of every problem depends on education.

In fact, it comes as near omnipotence as can anything human

Nothing is beyond the compass of education. It deals in miracles. It can make of the ignorant immigrant a successful business man in two years, it can develop into contact with the world the blind, deaf mute, Helen Keller, it can even work successfully with the tiny modicum of brain found in the skull of the chicken.

I do not mean the chicken who rides in the car. I mean the one which used to get under the wheels.

I have noticed that even the chicken gets wiser as time goes on.

Every traveled automobile road used to be a slaughter house for foolish fowl.

It is true it was always the hen that got killed.

The rooster, with superior masculine mentality, used to stand sensibly on the side till the car passed.

It was the hen which made hysterical flights back and forth until finally the heavy wheels sent feathers flying and finished the tragedy.

But you who ride will agree with me that the hen is learning caution.

In some mysterious way the word has been passed down

* Vice president Chandler Motor Car Co., and member Highways Committee, National Automobile Chamber of Commerce. Address (partly abstracted) delivered at Second National Conference on Education for Highway and Highway Transport Engineering, Washington, D. C., Oct., 1922. Illustrations kindly loaned by Concrete Highway Magazine, Chicago.

On the Schuylerville road near South Glen Falls, Saratoga county, N. Y.

from one generation to another that automobiles are a great thing to avoid. So the mortality constantly decreases

If, into the puny head of a chicken, it be possible thus to force knowledge, how infinite are the possibilities in other directions?

The subject of how our educational institutions may aid the course of highway transport is so big that I have need to be careful lest this presentation be encumbered with excessive detail. I shall try to concentrate on those factors which are regarded by our industry as fundamental.

You have a right to be answered on certain elemental questions before we can reasonably expect to enlist your cooperation.

Is there a future for highway transport?

Will it offer an honorable, useful and remunerative calling to those who adopt it?

Are we in time, or has the subject been already over-exploited?

All Depends on Transportation

It seems to me that the right answer can be made in a few words.

None will deny that food, fuel, raw material, finished product and facile passenger communication are highly necessary, and that whatever brings them to the people at lowest cost constitutes public service.

If this be conceded the case of highway transport is established.

I doubt not that there will be ample regards for trained men who can develop the highways so that they may take their proper share of distribution.

Far from being over-exploited, highways transport is still an infant industry. In fact, all transportation is a young science.

Go to the authorities and try to study the history of transportation, and you will be amazed to find that until the last one hundred and twenty years there is no advance.

The Romans, and later the French, under Napoleon, built some good roads, and that represents the sum total of progress until the first decade of the nineteenth century.

It is hard to realize that anything so vital to human kind as transportation should have been so slow in its development.

The man of Nazareth, founder of the faith, and George Washington, founder of his country, living 1800 years apart, knew only the same mediums of transportation.

On land they could be hauled by man or beast. On the water they were dependent upon the straining muscles of the oarsman or the vagaries of the wind.

It is an amazing thought when set against all that happened in the world in that time.

The culture of Greece, the far-flung power of Rome, the mighty empire of Charlemagne all had their rise, their history and their fall.

The Dark Ages and the Middle Ages came and went. The Crusades wrote their dramatic history.

In the fifteenth and sixteenth centuries came that great outburst of exploration that carried the mariners of Europe all over the world to the discovery of new countries.

Three great revolutions, in England in 1688, in our country in 1776, and in France in 1793, made their contributions to free institutions.

Yet during all that long period, transportation stood still.

In other directions, marvelous advances were made.

Progress in Other Directions

Inventors achieved both for good and ill.

They discovered gunpowder. They invented printing.

The great art works of all time, paintings, statues, buildings, mountain peaks of human genius, all came to the world while transportation remained primitive.

Actually the history of modern transportation can be written within the last 120 years.

Fulton with the first steamboat in 1806, Stephenson with the first locomotive some score of years later, the electric trolley in the final quarter of the last century, and finally the internal combustion motor vehicle on land and water, and in the air, represent more progress than had previously been made in all recorded history.

While much has been accomplished, much remains to be done.

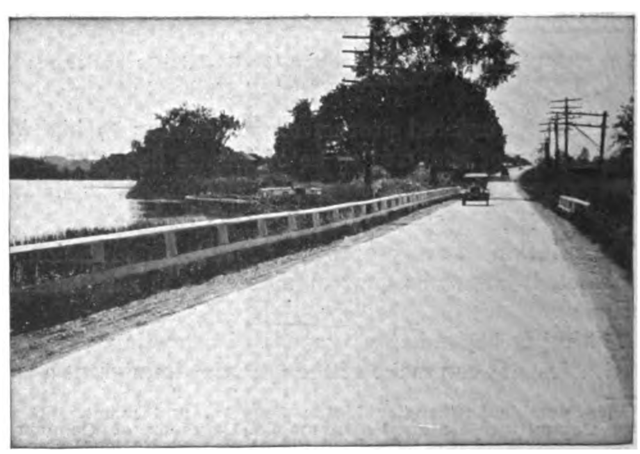
Education is urgently needed to give highways transport an efficiency that previously it has lacked.

Up to date we have, to a large extent, simply blundered along.

I doubt not that there have been made automobiles that did not fit the highways, and highways that did not fit the automobile. There have been iniquities of taxation. There have been faulty choices of routes. There have been many economic mistakes, based mainly on the fact that the science is so young and the elements so huge.

I believe that education is ready for this immense task, because its great modern keynote is practicality.

This was not always so.



Along Seneca river and New York barge canal, Onondaga county, N. Y.

In days gone by, and particularly in the older countries, it was the function of college training to make what were smugly called "gentlemen."

The student of then bothered little about the accumulation of education.

Diversion was more important. He sought a roystering four years, with some such occasional prank as smashing windows, burning a barn or dropping a policeman down a sewer.

But the intensity of modern competition has changed all this.

The student cannot afford to waste his time, and the colleges, therefore, may live up to their high ideals of service to the public, demonstrated in turning out yearly useful and efficient specialists.

Perhaps the greatest boon of transportation is not a technical one. It does not have to do with subgrades or road surfaces, with automobile horsepower or with taxation schedules.

It concerns rather the lowering of the costs of the necessities and enjoyments of life so that happiness may be widespread.

This has an importance that carries it into the realm of economics and statesmanship.

It is the reply to the malcontent or Bolshevist who raises his voice against our institutions.

We Accept Changes Quickly

Changes come so swiftly in our country, and we are so facile in conforming to them, that we fail to comprehend what the combination of the engineer, educator and business man is doing for home contentment.

To prove my point in a homely way, I should like to contrast the daily life of the average citizen today and twenty years ago.

Then there was little for father but work. The family hardly knew him.

His transit to and from his place of business was made in the darkness of morning or the dusk of evening.

Dinner, a wearied glance at the evening paper, and bedtime, formed his nightly program.

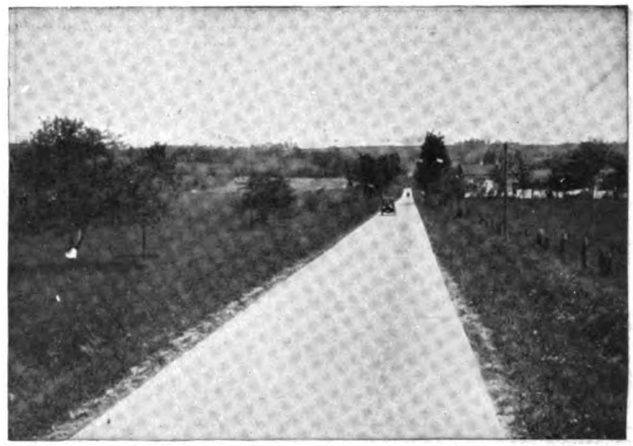
The cost of taking the whole family to the theater was prohibitive, for amusements had not yet been popularized.

Saturday afternoon he spent alone at the baseball game, economy once more eliminating the family.

On Saturday night, in the pre-Volstead period, free lunch and the companionship of the saloon pulled him from home.

Sunday morning he slept late. His newspaper filled the afternoon, and the evening was spent at the cigar store. The only time he saw the whole family was at the Sunday dinner.

The Stone House road near Little Falls in Herkimer county, N. Y.



A straight stretch on the Utica-Trenton road in Oneida county, N. Y.

That was twenty years ago. Now mark the amazing change.

The American wife should rank the automobile and the moving picture with the 18th and 19th amendments, for they have restored her husband to her. In fact, along with other things modern, they ave opened a new family life.

Father, even the father of modern circumstances, can sleep later now. His automobile materially cuts his time to the office or shop. Also it gets him home earlier.

What a vista progress has opened for the evenings!

Each night makes its own appeal.

On Monday night the whole family can go to a high class moving picture at small cost.

On Tuesday they gather round the radio. Wesnesday they can hear all the master works of music in a victrola concert.

On Thursday father and mother go to the club dance, for the modern jazz has made stepping so easy for the head of the family that he imagines himself another Donald Brian.

On Friday perhaps it may the school basketball contest, or some of the many other healthful athletic activities intelligently controlled, that are so much to improve the physical equipment of the American boy.

On Saturday afternoon there is a chance to play golf at the inexpensive club, or even on the public links.

All Out for the Big Picnic

But Sunday is the big day.

The whole family gets action. No staying in bed then.

Everybody goes to the big picnic.

Into the Ford are crowded father, mother, five children, grandmother, the dog, newspapers, fishing poles and even occasionally a bird cage.

Nothing could be finer than this day of family outing.

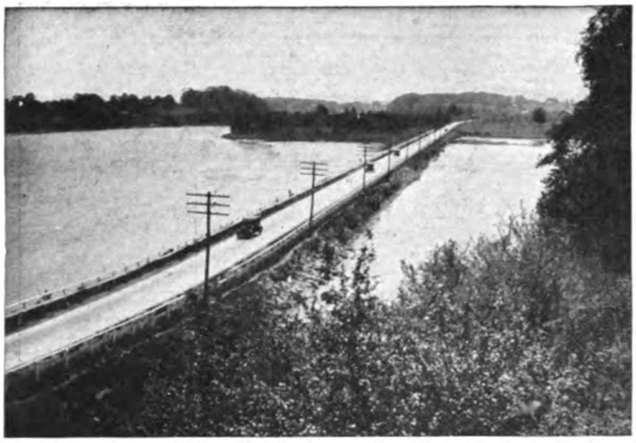
It brings the children into the healthful open.

It is family companionship, during the only period of life when this is possible, before the children have grown old enough to leave the home hearth.

Of course all development carries its problem.

I would not contend, for example, that the moving picture is an undivided gain.

Something could be done for its morals, and much, despite many undoubted educational phases, for its intelligence.



Where the Oswego-Syracuse road crosses a river near Oswego.

For another thing it is the foe of home cooking.

No matter how many graduates the cooking school may turn out, the moving pictures will get them if they don't look out.

Mother used to be content to spend all afternoon preparing dinner. She knows better now.

By grabbing a slice of ham at 5:45 she can throw dinner together in 15 minutes and be free to spend any afternoon at the movies.

Not that I would seem to criticize the gentler sex.

This would call for a courage far more overwhelming than mine.

Nor has man always done such a good job as to warrant him in criticism.

It was to a woman that man gave the job of making the first American flag, and yet he made her wait a century and a half to vote for it.

Is Vital to All Sections

In directing his attention to highway transport, the educator does not limit his scope. He has a subject which is just as vital to the cities as to the rural section.

First consider the farmer. Here is what the combination of motor car and good roads means to him:

It gives access to the nearby town and thus ends his isolation.

It brings the school nearer to his children.

It shortens the distance from the doctor's office.

It carries his newspaper and magazines.

It delivers supplies of all kinds to his kitchen door.

It gives him more time to work on the farm.

It enables him to buy land for its productiveness and low cost uninfluenced by contiguity to railroads.

He can move his produce when prices are right, and develop not only a broader market but a more stabilized one.

Equally decisive is the advantage to the city worker of moderate means.

His car permits himself and his family to escape urban squalor and congestion for the health and beauty of the suburbs.

It is available to himself and his family for a hundred valuable services.

The interest of the millions, the truest basis of economic law, demands better highways transportation.

The wealthy tourist and the truck using corporation form but an infinitesimal portion of those who will gain.

The benefit will spread itself principally to two great classes as follows:

First: To three and one-half million farmers dependent upon their automobiles.

Second: To as many more city dwelling families with incomes of less than $4,000 per year, who with the farmers, own two-thirds of all the automobiles sold.

The motor vehicle actually gives this country some 11,000,000 transportation monopolies, all, whether truck or passenger car, subject to schedules and routes made by the owner. This means individual transportation.

I have spoken of "individual transportation." I should like to analyze that term, and undertake to show you gentlemen a most interesting reversion of method.

Generally speaking, our modern development has been from individualism to centralization.

Our country began as an association of individual states, but their boundary lines constantly became less important and the federal idea more dominant.

Tendency Toward Centralization

The experience of the workman and manufacturing processes affords another example.

Formerly the workman's productiveness depended upon his possession of the tools of his craft. The carpenter with his saw, the shoemaker with his awl, the blacksmith with his hammer, the printer with his stick, each carried his trade with him wherever he went. That was individualism.

Then came a great modern development.

Huge machines supplanted the tool. They enormously increased production.

You furnish another example. You illustrate the tendency of centralization in your own home every day.

You don't go down to the pump or to the well for water. You don't light the kerosene lamp. In many cases you don't even produce your own heat.

All these come from central power plants.

For centuries individualism dominated transportation.

The horse and wagon, the man and boat, are instances.

Then great steamships, steam railways and electric trolleys took transportation from the individual.

This was combination, it improved service, and these great mediums will always be with us in a place of commanding importance.

But transportation has lately presented the paradox of a return to individual facilities.

In both freight haulage and passenger transportation, the motor vehicle has turned back the hands on the clock of time, and we now supplement centralized transporta-

Traffic is always heavy on the Albany Post road. Scene in Westchester county, N. Y.

tion with an individual medium, subject entirely to your own whim, preference or need.

Essentially highways transportation need not conflict with other kinds of distribution.

It cannot haul the two and one-half billion tons of freight carried by the railroads in a normal year, nor transport such part of their billion passengers as ride long distances.

It cannot give service in congested municipal areas to the sixteen billion yearly electric trolley passengers.

But it can serve the public over two and three-quarter million miles of highways, the greater portion of them not cared for by any other transportation element.

I have discussed general considerations, have analyzed the present status of highways transport, and have briefly indicated some of its possibilities.

Six Courses

I should like now to be more concrete and to make recommendations concerning the subject to which educators should give thought in arranging their courses.

The subject is so big that it involves almost a whole new system of education. I genuinely believe that the various branches of highway transport cover a wide enough range to furnish the exclusive subjects of training for a very considerable college.

Without attempting to subdivide the work or to deal with its minor phases, there seem to me six main types of men you must produce. There are highly remunerative opportunities for all.

The following is the list:

First—Road builders.

Second—Motor car producers.

Third—Highway financiers.

Fourth—Highway lawmakers.

Fifth—Transportation analysis.

Sixth—Real estate experts.

Perhaps the biggest task of all falls to the road builder.

In this class I naturally include the highway commissioner, the highway engineer, purveyors of materials and the contractors who actually do the work.

To this group is allotted the major responsibility of building roads of sufficient carrying capacity to take whatever traffic be demanded by the nation's economic needs.

These roads must not only join present populous points but must open new territory.

Along with the roads there must be provided adequate maintenance at not excessive cost.

It has been pointed out by the field marshal of good roads, Chief McDonald, that our greast problem is to see that our highways keep pace with increasing highways rolling stock.

There has been three times as much investment in rolling stock between 1910 and 1921 as has been expended in the same period for highways construction.

It is an enormous responsibility to plan an adequate highway system for a country covering three million square miles.

Six hundred million dollars were expended last year by federal, state, county and township divisions upon highway construction and maintenance.

In the program is involved the biggest expenditure ever assumed by this country except for war projects. Its total dwarfs the cost of the Panama canal.

There are questions of proper routes, studies of subgrade and proper surfacing.

The men who will assume this responsibility cannot be too efficient, cannot be too highly trained.

Need Experts in Finance

The third requirement is that our colleges should develop intelligent specialists on highway finance.

The greatest deterring factor to more and better roads is the question of paying the bill.

There will be acclaim for the expert who can determine the proper basis of automobile taxation and the equitable allotment of highway construction costs.

Let me show you one or two of the problems.

Taxation is a most intricate science. It does not always work out as planned.

An excellent instance is to be found in revenue laws, which put the heavier tax on what were termed "luxuries."

The war made this a very popular policy.

Among other items congress taxed long distance telephone calls, amusements, phonographs, moving pictures, automobiles and automobile repair parts. None of these taxes were aimed at the farmer, yet he it was who suffered most, for all these items are vital to make tolerable his life on the farm.

The telephone ends his isolation. The phonograph makes it possible to bring the master works of music to his home and children. The moving picture is one of his sources of education and diversion. The automobile is the basis of his contact with the outside world and his medium of transportation.

As owner of one-third of the automobiles in the United States, he suffered more through the parts taxes than any other one class.

Do not forget that when the farmer's automobile drops into a chuck-hole and breaks an axle, it is tough news for himself and his family. Even his neighbors regret it. But the United States government is no "good Samaritan," for back of the barn lurks the tax collector waiting for his 5 percent on the replacement axle.

We have always argued that any transportation tax is a hardship to our people and reflects itself in increased costs, yet we still are worrying along under automobile excise taxes.

We believe that these taxes should now be properly eliminated since they discriminate against an essential business. It is cheering to report that many members of congress are coming to our viewpoint.

Perplexing problems are involved in the financing of highways programs.

We believe that two classes of our people should pay for building and maintaining our highways.

First: Those who own motor cars.

Second: Those who do not.

This is another way of saying that since everybody benefits everybody should pay, the major part of the cost naturally going to those who benefit most.

There are those who seem to believe that not enough taxation can ever be piled on the automobile.

We want to pay our share, but there is a point when over-taxation of any group becomes injustice.

As a fundamental we advocate that taxation shall come under one jurisdiction and should be uniform in type, if not in extent.

All funds levied from the automotive industry should be applied to the highways since those who pay such levies

(Continued on Page 26)

Exceeding the Saturation Point in Selling

Policies Developed by Business Concerns to Sell Successfully and Continuously in a Buyer's Market—Substitution of Other Lines—Improving Service

TALK about the "saturation point" for automotive vehicles has been so general in recent years (but not in recent months) and so much has been said on this subject by eminent economists that a number of otherwise well-informed automotive manufacturers have given quite a little thought to this subject, and it has become a topic of considerable interest. This gives point to the following article reproduced from a recent issue of System, by special arrangement.

In many lines of business there has for many years been a bugaboo to frighten managers. This bugaboo, generally referred to as "the saturation point," during all the period of its life seemed just around the corner—but no one ever met it face to face. Notably in the automotive industry, where expansion has been pronounced since the industry's inception, the time when the market could absorb no more of the product seemed fast approaching—yet the industry was usually running a few weeks behind its orders.

Not until the last very few years has the average business executive seen the fallacy in this theory of possible saturation: that the market can and will, under right conditions, absorb almost unlimited quantities of a commodity, and that when the quantity becomes in excess of this very high limit, there inevitably occurs a process of selection which weeds out some of the excess production capacity by a natural elimination of the least fit. And as one phase of that general proposition, it is apparent that however near a market may be to the theoretical "saturation point" for a class of commodities, it is not saturated with every article in that class.

A market can, and will, absorb something if the product comes to the prospective purchaser with just the right appeal and the right price.

It is doubtful whether a "saturated market" could be more nearly attained than that which prevailed when, beginning in 1920 and continuing in many lines until a few months ago, the market changed from the one-sided condition of being a "seller's" to the equally one-sided leaning toward the buyer's advantage. With few purchases being made and the channels of distribution glutted, sellers were faced with the necessity of working out policies and methods which would keep the doors open and the sheriff away.

The starting point toward such policies and methods was the executive's realization that goods could be sold, that the "saturated market" was a diminution of demand rather than a cessation. And working from this premise, not a few managers kept business growing all the while—or lost less volume than "everybody" recognized must be lost.

Beginning with this elementary fact, these managers set out to make a careful study of product and of demand at different prices. The study has led them to various conclusions. But most of them developed ideas which led them on to better business—and it must be remembered that plans and policies which would bring that result during the slump are of a sort which would accomplish more when business is running along gathering momentum.

"When Sales Fall Off in One Line We Begin Pushing Another"

Take, for example, the policy to which the general manager of the Simonds Manufacturing Co. ascribes the steady maintenance of volume in his concern. It is a policy by which the strongest sales effort is applied along the line of least sales resistance, essentially the policy of the concern which, dealing in coal and ice, keeps force and equipment busy on coal in the winter and ice in the summer.

"We have found by experience," explains J. E. Kelley general sales manager, "that by keeping a well-organized system of orders coming in and sales going out of the many different articles which we produce, covering as it does articles going to almost every kind of industry, we are enabled to make a chart which shows the trend of business almost identical with charts gotten out by professional statisticians; and by watching these we can determine when business is gaining or losing.

"In a time of depression when prices are likely to sag we urge our men on the road to work for customers' immediate needs and not to load them up with a stock of goods on which they will likely lose money by a decline in price. When from careful observation we can see an increasing demand with stable prices, we urge our men to get all the business possible. And if we feel—as we do feel at the present time—that customers should buy ahead for their wants, we urge a stocking up.

"We constantly strive to bring out something new and of vital importance to the trade. Whenever we feel certain that we have obtained something which will work for greater economy to the user we push this particular article to the limit."

Fundamentally similar, superficially different, is the plan of the Electric Vacuum Cleaner Co. In its field there has existed a division of thought, with one side advocating the suction principle and the other the partisan of the motor-driven brush, explains Julius Tuteur, its president. So his concern brought out a new model that combines the two principles.

Besides this, another model was designed that was adapted to the needs of a new market. "The sale of attachments to all vacuum cleaners is substantial," declares Mr. Tuteur. "The attachments are used to clean curtains, mattresses, clothes, and the like. We brought out a special light-weight cleaner for this purpose, calling it the Premier Handy, and very quickly discovered a large market for it among garages for cleaning automobile upholstery, in stores and homes for cleaning shelves and bookcases, also for cleaning billiard tables and so on. It is equipped with a shoulder strap; the cleaner, with attachments, weighs a little over six pounds. We have not been looking for sensational sales ideas, but have found the answer to market conditions in the progress of our research and experimental laboratory."

Not a few concerns have discovered the secret of in-

creased sales by bringing out a new product with an improved sales appeal. Not every firm has, however, found so ingenius a plan as has the Todd Protectograph Co. in its new form of forgery-resisting check, along with more conventional improvements in the machanics of the company's check writers. An executive describes the selling plan: "We made attractive offers of quantities of our checks furnished in an attractive ring binder, in combination with check writer and forgery insurance policy for $5,000 or $10,000.

"A campaign of public education was carried on through the daily press, magazines and trade papers, for the use of checks rather than cash in payroll and other disbursements with the idea of reducing the crime wave by substituting checks for cash. The executive work of the sales manager was supplemented by appointing various officers of the company as regional directors, each one charged with the duty of cooperating with the managers and salesmen in his particular region. A bonus was given to salesmen on all orders above a certain fixed quota."

Similarly, a venture into a new field, plus mechanical improvements of the established product, helped materially in saving one large typewriter company from what seemed really a "saturated market." Of this situation the company's president says: "We have been feeling increasing sales resistance since 1920. A considerable part of this, so far as typewriters are concerned, came from overequipment of the largest users, which equipment was obtained during the war and times following the armistice, and left many users with surpluses which they had to use before they would buy new typewriters.

"About the time that increased sales resistance became noticeable, we expedited certain important improvements in our product and brought them together in a new model typewriter. It is a notable improvement over our previous model, and consequently a help to use in meeting sales resistance.

"Just prior to that we placed on the market another typewriter which was a new enterprise for a standard machine company. This machine was an instantaneous success on the market. It was a great support to our sales volume when our regular standard line was meeting with extra sales resistance.

These Concerns Sell in Increasing Volume Despite "Saturation"

"Later, we were enabled to make some reductions in the price of typewriter ribbons and carbon papers, and that is having a favorable effect not only on the public but also on our own sales organization. These price reductions were not radical and were justified by reduction of manufacturing costs."

So much for bringing out a model with advantages of design and the like to sell it when "the public isn't buying." Still another plan, less obvious perhaps because it is so simple, is that of producing something in the established field, but producing it so that it can be sold at a price which opens up a whole new market. The Parker Pen Co. did essentially that when, at the earnest behest of a district manager, it developed its "Duofold" pen, which is a very large pen made up in two colors to sell at a higher than market price.

The two colors make it easily recognizable; the high price, quite contrary to the usual theories of the effect of price in a saturated market, made it desirable to a very large class of customers. And as a result, according to Geo. S. Parker, president, sales have grown at a rate wholly beyond what might logically have been expected by the most optimistic.

On the other hand, the American Multigraph Co. and Kranich and Bach found new markets open to them when they devised ways to pull prices far down on parts of their lines.

The importance of a low price appeared when analysis of sales of the American Multigraph Sales Co. showed that the rebuilt division was doing an increased volume while the sale of new equipment was falling off. H. C. Osborn, president of the company, tells what was done.

"Our engineering department was instructed to redesign our $250 equipment (the lowest priced equipment we made) so as to reduce the cost of manufacture without sacrificing quality or usefulness, so that it might be placed on the market at a selling price of $150, and to have this model ready for the sales organization by Jan. 1, 1922.

"The task was accomplished. The new model was extensively advertised and pushed at the first of the year. The result exceeded our expectations, and our production schedule, which had been planned to take care of what we thought the demand would be, fell far short of the requirements. While every effort was made to increase production to take care of the demand, at the end of our fiscal year last July, we were still behind in filling orders.

"The introduction of this new model had a splendid psychological effect on the sales force as well. When salesmen cannot get business they get discouraged and their battling spirit is at low ebb. But when they find business coming in readily they brighten up and are on their toes.

"While the individual orders were much lower than the individual orders before its introduction, they were orders! and this put heart in the salesmen, with the result that they went out and sold our higher priced equipment as well."

By producing a very small grand piano Kranich and Bach have been able to reach a new class of customers because of the difference in price between the large and small grands. Louis P. Bach, president of the company, explains: "We have concentrated our advertising to the consumer almost exclusively on this one style of grand piano, and it has not only increased the output of this particular style but it has also carried with it a similarly satisfactory increased output among our other styles and sizes of grand pianos."

Thus we see essentially the same principle working out in the same way in two such widely divergent fields as pianos and mechanical business equipment. Not altogether unlike it is the principle which has been followed by the Sanymetal Company, in up-grading the quality of the product as changing conditions have made this practicable. R. F. Carpenter, president, describes his use of this idea:

"When we hit the increased sales resistance that started with the slump, we made every effort possible to improve our product. Instead of using low-grade steel we purchased the highest grade of material obtainable. This allowed our finishing department to produce a much better looking product at a less expense; thus the cost of the better-grade material was offset by a saving in labor in the finishing department. We gave much more attention to small details, putting in a very close inspection depart-

(Continued on Page 24)

Handling Material in Automotive Plant

System at Studebaker Plant—Tractors Effect Large Savings—Machine Shop Layout and Handling of Scrap Are Features

ECONOMY in handling material was the general subject of a practical talk by M. R. Dennison, of the Studebaker Corp., South Bend, Ind., at the material handling meeting at the convention of the Society of Industrial Engineers, held in New York Oct. 18, 19 and 20. For several years, said Mr. Dennison, overhead expense has received probably more attention than any other single item contributing to cost. Entering into the question, and more so of late, has been the problem of economy in the movement of material. Some economies in that line accomplished at the South Bend plant of his company are given in what follows.

Divisions of Plant Outlined

The plant is laid out in seven divisions, all under the direction of a production manager. These are the gray iron foundry; tool, die and maintenance; power; machining and assembling; stamping; forging; and the stores division. Each of the first six has within it a separate stores department under the direction of a general storekeeper. One transportation department, one receiving department, and one scrap department, serve all divisions.

The rough stock and work in process in the stamping and forging divisions is handled entirely by overhead cab-cranes, running the full length of the building and operating transversely as well as longitudinally. Depressed tracks lead into steel yards and sheet metal stores for receiving of material. Special hoisting devices are used in connection with the handling of sheet metal. Hand labor is eliminated, with the exception of short moves of a few feet. Steel baskets and large wooden boxes, which in emergency can be moved by a lift truck, are used for transferring forgings in process, but are, in 98 percent of the cases, lifted and moved by crane. Stampings in process are handled on four-wheeled, heavy duty trailer trucks. See Fig. 1.

It was found that close attention to the handling of bulk material, such as bar steel or sheet metal, gave a greater chance for quick economy than the handling of other stock. Gray iron castings are made at the Studebaker foundry about one mile from the main plant and are transported by freight car between the foundry and main plant divisions. Castings are placed in large box trucks at the foundry, part numbers and quantity being shown on a tag on each truck, and trucks are then loaded in tiers in freight cars. The tag eliminates recount, and the truck one handling at the main plant. In emergency, castings are hauled on wagons from the foundry by gasoline tractors.

The tractors are favored for long hauls on rough pavements, for two reasons: initial cost and higher speed. Large castings are put in freight cars and not in trucks, and the movement is handled, wherever possible, so that cars are delivered to the spur track adjacent to the machine shop and unloaded directly from car to machining department.

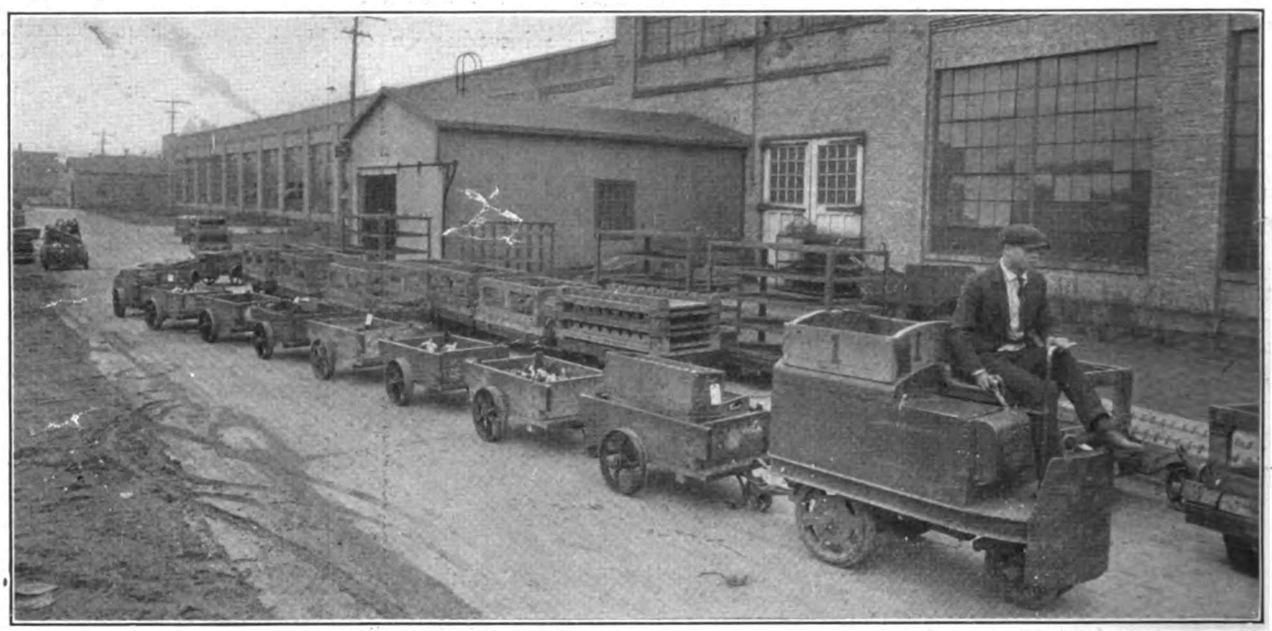


Fig. 1—The tractor-hauled train runs on a schedule through the departments. It is required to make a right angle turn through a 6½-ft. doorway, sometimes with 50 cars in the train.

Two four-story buildings, 520 x 520 ft., are utilized by the department and storerooms for assembling motor, axle and other units. Each building has two wings, with crane bay in the center, covered by glass; in each crane bay two 5-ton overhead electric cranes operate. A depressed track runs into each building in the crane bay, and extends the full length of the building. A driveway is also maintained through the crane bay for trucks and pickups. The material, upon receipt, is checked for count, weight, etc., and at once is transferred to some sort of truck on

Reproduced by special editorial arrangement, from Iron Age, New York.

wheels. The keeping of material or wheels, particularly in the receiving department, is emphasized. On each side of the crane bay are projecting balconies for landing of loads by the crane.

Different types of trucks are provided, Fig. 2. Large dock trucks are used for sending many boxes of small items to the storerooms at one trip. Trucks with a special rack are provided for many items where the finish demands protection. By an arrangement with some suppliers the rack in which they ship material is utilized in receiving, checking and sorting. Care is exercised by the receiving department to load material so that all material on the same truck is to be stored about in the same locality, and all in the same storeroom. The material is then transported by automatic lift truck a short distance to the receiving inspection, where each lot of material, as loaded by the receiving room, is kept together except for rejections. After inspection, the automatic lift truck delivers back to the receiving dock and the overhead crane carries the truck from there to the nearest projecting balcony to the point of storage. The hooker-on, from the ground, signals the particular balcony by electric horn, while the load is in the air, so no time will be lost in landing the load.

Fig. 2—One of the features is the large number of trucks, some of which are kept in stores equipped ready for transportation with wheels, axles, etc. Of box trucks there are 3,000 of three types.

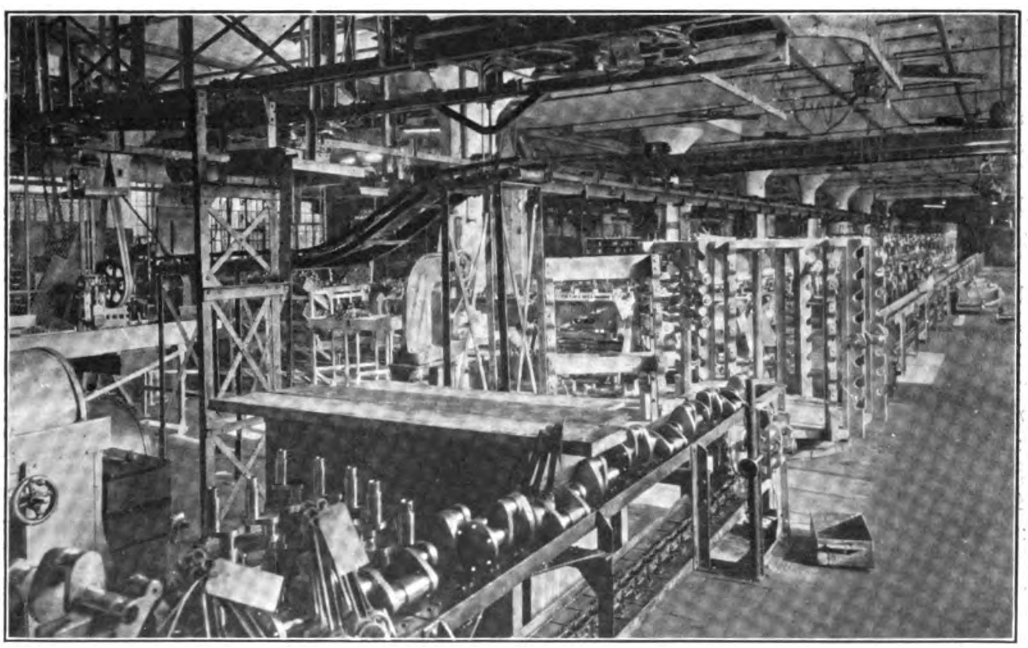


Fig. 3—Some of the overhead chain conveyors are equipped with hooks on which work is hung. Belt conveyors of all types are found, some with deflectors for delivering the work to the proper point for the next operation.

The layout was made with a view of making it necessary for every piece of material to pass through these storerooms before going to assembly lines or stands. All material consigned to points above the first floor and going from the first floor is handled by crane. Upon receipt of the material by the storeroom, it is taken to the proper bin and there unloaded. The handling of material to the assembly line is one of the phases which has resulted in a large saving. Banks of material have been laid out for each assembly floor so the foreman will have just enough to maintain production. After the banks have been established, deliveries are made daily in exact sets, on a basis of finished car production.

The stock is stored adjacent to the assembling operations where used. Sets are assembled each afternoon by the stores men and placed on steel benches just over which is a wicket window opening to the assembly department. By simply putting up the wicket at the proper time, the stock is available to the assembler. Back orders are maintained where the supply of material in the stores is not sufficient to put out a full day's supply.

All material down to the smallest cotter pin is handled on the basis of sets. When the producer is short one of two things must be done; he must produce a defective piece, properly tagged by an inspector, or his foreman must give the storeroom a requisition for what he wants, the valuation of the goods he gets on this basis being charged against his department as an expense. Since his expense is budgeted and he is only allowed to spend so many cents per car on each 10-day period, he is

(Continued on Page 28)

Salon Display as Splendid and Successful as Usual

A Few High-Priced Newcomers, Both Domestic and Foreign, Add to Splendor of First New York Display—Fine Coachwork—Construction Novelties

WITHOUT going into superlatives it is difficult to describe this year's annual automobile salon, which was held at the Commodore Hotel, in the ball room, during the first week of December. The first big New York show of the season was just as brilliant as its predecessors, and showed a few points of marked advance. Thus, the number of foreign cars to be displayed was the greatest since 1914, and included for the first time Voisin, as well as examples of both the French and Spanish Hispano-Suiza cars. Both these makes are and always have been in the very highest priced class, in fact at one time, the French built Hispano was the highest priced car in Europe, which means in the world.

Eight nations were represented, England, France, Spain, Belgium, Italy, Germany, Austria and the United States, these including all that have an automobile manufacturing industry of any magnitude. In this respect, its truly international quality, it may be considered as ranking with, or perhaps above, the recent Paris salon or the London Olympia display.

The Exhibitors

Those who exhibited cars are: Benz, Brewster, Cunningham, Daniels, Duesenberg, Fiat, Hispano-Suiza, Hotchkiss, Isotta Fraschini, Lanchester, Mercedes, Minerva, Panhard, Rolls-Royce, Rubay, Steyr, Sunbeam. Voisin and Winton.

Exhibitions by coachmakers included Cadillac, LaFayette, Lincoln, Locomobile, Marmon, Packard and Peerless.

Coachwork exhibits were by Brewster, Brooks-Ostruk, DeCausse, Demarest, Fleetwood, Healey, Holbrook, Hume, J. B. Judkins, LeBaron, Locke and Rubay.

An unusual automobile, entirely new to the American motoring public, was displayed at the salon for the first time, in this country. It is the Austrian Steyr, exhibited by the Foreign Motor Car Co., Inc., of which Paul Ostruk of Brooks-Ostruk Co. is president.

This is a six-cylinder machine of medium weight and medium price. Concentrated in this single, clean, neat chassis is all the European engineering progress made since 1914.

Benz & Cie, sole distributors of the Benz in this country, exhibited a de luxe cabriolet, an inside drive limousine with gold fittings, a six passenger touring car and a town brougham.

One of the great suprises of the salon was the return to America of the famous French Hotchkiss car. This is one of Europe's best known automobiles and its appearance is of special interest because the Hotchkiss company was founded in France in 1871 by the eminent American engineer, Benjamin Berckly Hotchkiss.

The British Sunbeam motors showed their six-cylinder limousine landaulette and also their six-cylinder chassis. This line has recently been considerably reduced in price.

European Design Tendencies

The Isotta-Fraschini Co. showed its cars equipped with front wheel brakes. Another tendency in design which was first conceived and put on the market in a stock car by the Isotta-Fraschini Co. is the eight-cylinder motor with all eight cylinders in a straight line. This year's salon showed clearly that the tendency in European design to adopt this type in foreign makes is tending to supplant the V-type motor.

The three Minerva cars displayed by Brooks-Ostruk strike a new note in body building. One of these was a cabriolet, with a number of entirely new features, the most striking being the raised panel effect which starts at the radiator, goes back to the hood in the form of a molding, extending along the length of the hood and cowl and windshield.

The Rubay Co. of Cleveland, Ohio, showed a special new type sedan cabriolet on a Peerless eight cylinder chassis. The top is permanent. The window frames are nickelplated, creating an inviting appearance to the interior.

As a closed car there is a maximum space of one and a quarter inches at the door hinge line, where in the past this space measured at least four inches, which gives the driver and passengers a wider scope of the road on the side.

This car is converted to the open type through the panels next to the door, which are hinged at the base line and when opened afford a compartment into which the frames, when folded, drop and fasten so securely no rattle can develop. This feature has been patented by the Rubay Co.

The Fiat Co. showed their de luxe sedan, four passenger, and also the de luxe touring, four passenger. There are a number of entirely new features in these models.

The Rolls-Royce exhibit included the suburban limousine, an entirely new Rolls-Royce body design, which is very distinctive and affords a roomy, comfortable body, coupled with very fine features of design and lines. They are also showing a sedan, a town brougham, and a four-passenger phaeton.

New High-Priced Four Cylinder

The newest French exhibitor, Voisin, attracted much attention with its two models. These were direct from the factory, being a town car and a small sedan, both bodies of French make. In the sedan the double plate glass windows on either side can be folded back and dropped into a panel within the door. The outward door closes over the dropped windows, holding them tightly so that there is no vibration, and the sedan is transformed into a typical open touring car, the top of which is collapsible. The same folding window system is applicable to the town car, where not only the side windows but a section of the windshield may be folded back or dropped into the door panel at will.

The Voisin, by the way, is a four-cylinder car. It is said to the smallest engine with the Knight sleeve valves. The cars on exhibition had a wheelbase of 140 in. and the price of the complete car is a little less than $11,000, undoubtedly the highest priced four-cylinder car on the market.

Beside the Voisin and the Panhard, France was represented by the Hotchkiss and the six-cylinder Hispano-Suiza. There was also on exhibition a four-cylinder Hispano-Suiza made in the factory in Spain. Italy had three makes, the eight-cylinder Isotta Fraschini, shown in eight body models, the Fiat of which only the "baby" four-cylinder was shown in an open and a closed body, and the Lancia, shown in the new eight-cylinder chassis made by lining up two four-cylinder motors at a very narrow angle. Germany presented the Benz and the Mercedes, Belgium was represented by the standard Minerva, and England showed the Lanchester, Sunbeam and the Rolls-Royce, although as the Rolls-Royce cars on exhibition came from the American factory at Springfield, Mass., they might qualify as American productions.

The newest American car was the Rubay, designed by Leon Rubay, which is built in Cleveland. It is a compact four-cylinder car on a chassis of 118-inch wheelbase and has the four-brake equipment. The radiator has a distinctive design.

The English Lanchester was shown in the Brewster exhibit, the long 150-inch chassis being fitted with a strikingly artistic coupe body, the forward part of which is suggestive of the old-time English coach. It was finished in deep brown with a two-tone effect, and the car on exhibition is valued at $16,000, the highest priced car in the show. The chassis alone, landed in this country, is priced at $10,500. The Panhard chassis on exhibition was valued at about $9,000, the Hotchkiss six-cylinder chassis at the same figure, and the speedy six-cylinder German Mercedes sport chassis, which had just arrived in this country, at $7,800.

New Mechanical Tendencies

There were a number of details of construction which were so widely shown, that is shown by so many different makers, many for the first time, that these might easily be considered as permanent features on the higher priced cars, and thus, as new mechanical tendencies for the coming season.

First and foremost among these must be mentioned front wheel brakes. This tendency growing very slowly has this year made a big jump in popularity, as a list of those makers using them would show. Isotta-Fraschini has advocated them for years, and the Duesenberg cars have been so equipped ever since they were brought out. This year, however, one notes these converts, some recent: Panhard, Rubay, Lancia, Hispano, Lanchester, Voisin, and Benz. All of these are manually operated with the exception of Duesenberg, which has hydraulic operation. In the majority of cases, the four-wheel brakes are on the foot pedal.

Another notable tendency which seems to have gained greatly in the past year is the straight-eight type of motor, that is the arrangement of eight cylinders in a straight line, as contrasted with the V-type exemplified by Cadillac, Lafayette, Lincoln and others. While the straight form gives a very long engine space, and thus, necessitates the use of a very large proportion of the total length for the power unit, it does present an extremely clean-cut, neat appearance as contrasted with its V-type competitor. Another point which is very much in its favor, is that the forked type of connecting rod, necessary on all V-type engines is entirely eliminated. With the forked rod, go all crankshaft bearing troubles, so the straight engine advocates claim.

As contrasted with this, at least in the matter of space taken up, the eight-cylinder Lancia presents many remarkable features which commend themselves. This, as previously mentioned, and as described and illustrated elsewhere in this issue, is a V-type engine in which the cylinders are set at a very small angle, 20 deg., this result being attained by staggering the cylinders. By this means, the cylinder block becomes so compact that it may be cast in a single unit, and the engine as a whole presents the height, width and length of a four-cylinder unit. By this arrangement, which has no outstanding mechanical or constructional defects, the power of an eight is obtained from the space usually required from a four of approximately half the power.

Other mechanical matters which appeared to have had much attention, with a resulting approach to perfection are springing and carburation. Springs are longer and heavier, and ride easier than formerly. The cars as a whole are hung lower, due partly to smaller diameter of the tires and partly to the springing. Frames appear to be of larger section but proportioned so as to give greater strength with little or no increase in weight. Both springs and frames are of better materials than were used formerly, the higher grade alloys being almost universal.

Many Fine Bodies Exhibited

As was to be expected of a show of this type, the bodies were unusually fine. Practically all of them were of the most luxurious and artistic form. Besides those bodies which have been mentioned specifically, the new Winton six sedan and the Judkins sedan on Cadillac chassis must be mentioned as worthy of more than passing mention. The latter was noteworthy not alone for its extremely simple and very pleasing lines but for the completeness and artistic value of its appointments. There were few bodies which sought to attract attention through shrieking color schemes, the majority being of dark colors, relieved by lighter stripes or set off by narrow panels of a bolder color. The striping of wheels, discarded for a number of years appears to be coming in again, as many of the finest paint jobs included this feature.

The show as a whole was a very successful one, the attendance was up to the usual numbers although not record breaking, and the sales made and prospects gained were said to have satisfied the exhibitors. All of which presages a remarkable success for the coming big show, which already has an overflow section planned for Madison Square Garden, for many years the scene of the main show, and the place where the industry made many of its greatest strides toward popularity.

Our Front Cover

A very important announcement in this number of Automotive Manufacturer is that of the Brunsene Co. of Watertown, Mass.

This announcement features our front cover, and contains matter of interest to automobile manufacturers. body makers and trim shops.

The Brunsene Co. will have a fine exhibit at the Automobile Body Builders' Association, which will be held in the city of New York, at the 12th Regiment Armory, Columbus avenue and 62nd street, from January 8th to 13th.

The trade has been extended a general invitation to see their exhibit which will be shown daily in Booth No. 8.

HOW WOMEN HAVE GUIDED the DESIGNING of CLOSED CAR

The efficiency, beauty and comfort of Durant closed cars are emphasized throughout their construction.

Both the Durant Four and Six cylinder coupe provide plenty of storage space conveniently accessible.

IT is easy to understand the beneficial influence of women in the businesses and professions with which they have elected to identify themselves. Yet, at first thought, it is perhaps more difficult to appreciate just how their influence has directed and encouraged the development and perfection of manufacture in which they have not been connected in a personal capacity. And yet it is true that almost every utility in use today, whether intended exclusively for feminine service or not, has benefited from the influence of women.

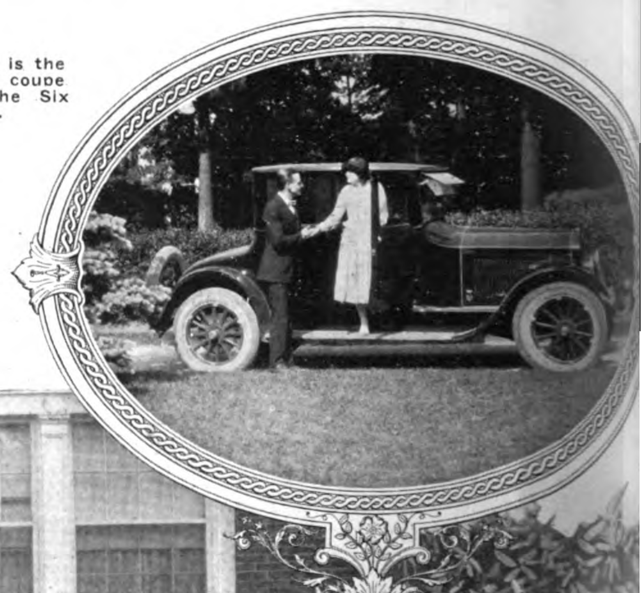
The automobile furnishes a typical illustration. The efficiency, beauty and all around comfort of the modern closed car is an achievement which should be credited as much to women as to men. While Milady has not concerned herself directly with all its intricacies of manufacture, she always has and always will, guide its improvements in design.

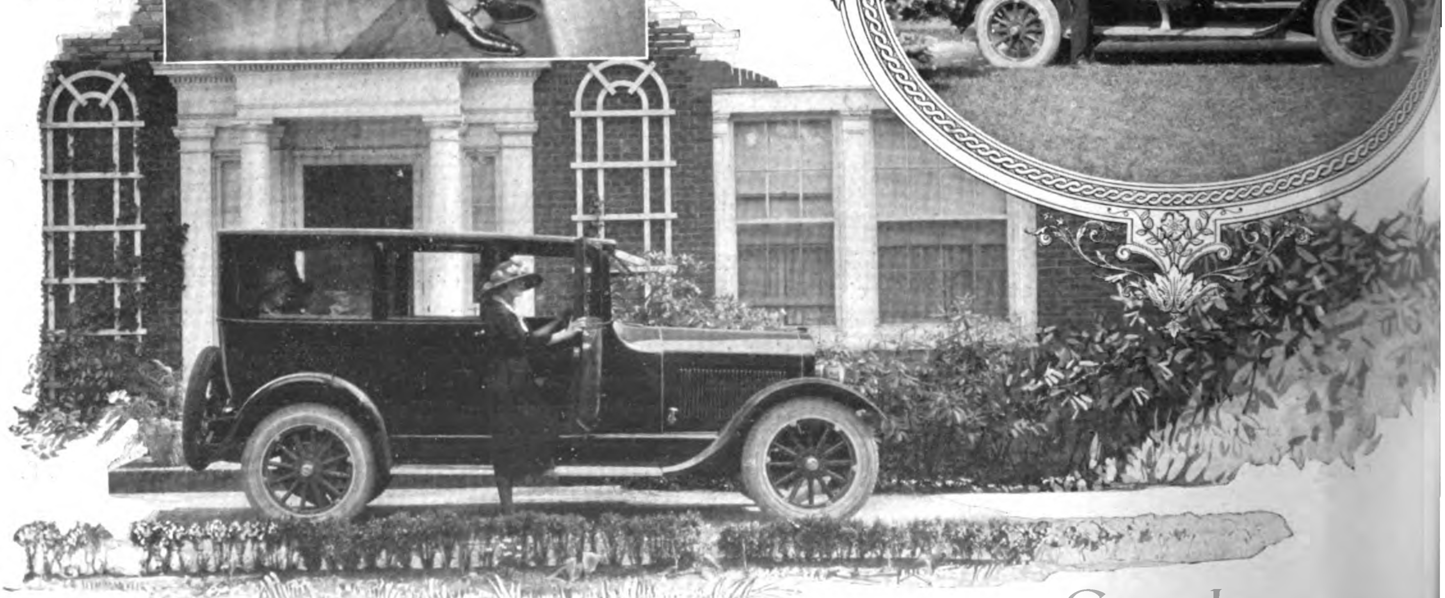
It is even possible to presume that the enclosed type of car would never have come into existence if it had not been for women. In any event, it would never have reached its present state of refinement. This truth is clearly emphasized in the Durant line of four and six-cylinder closed cars. We m[en]tion these models for the reason [that] they typify the wonderful advance[ment] which has been made in modern clo[sed] car design.

Inasmuch as one's first impressio[n of] a closed car is gained from its ge[neral] exterior appearance, we will first [con]sider the Durant models from [that] viewpoint. Here Milady finds her i[deals] of beauty, her appreciation of g[raceful] lines and balance and her requirem[ents] of conservative elegance and g[ood] taste luxuriously gratified. Du[rant] closed cars in both the four and [six] cylinder models interpret in de[sign,] coachwork and finish, the most acc[ept]able practices of modern crafts[man]ship. And with the charm of their [at]tractiveness is the assurance of d[urability] for they are substanti[ally] constructed throughout.

While the average woman may [not] be interested in the detailed desc[rip]tion of the many mechanical impro[ve]ments in Durant construction wh[ich] make for this substantiality, she [is] nevertheless concerned in the re[sults] which they have attained. For [ex]ample, the Durant Tubular Backb[one] is in itself an engineering achieve[ment] which every woman will appreciate [be]cause it was largely through her

At the right is the Durant Six coupe Below is the Six sedan.





ınds for easy riding qualities, less viıtion, a freedom from the annoyance body noises and a longer period of ›uble-free service that it was dened.

[he Durant Tubular Backbone keeps : whole frame of the car rigid. By ng this it forces the springs underıth to absorb all the shocks of the ıd. Mounted on such a firm founion, the body panels and joints are : subjected to tortional strains of even road surfaces. Therefore the aking and rattling which is experi:ed in nearly all other closed car lies is reduced to a minimum. Bese of this, the body is preserved in ›d condition even after a long iod.

[o those mechanically inclined, it l be of interest to know that the ırant Tubular Backbone also perts the independent mounting of : various mechanical units of the ıssis in such a way that they are ıdily accesible for easy adjustment replacement.

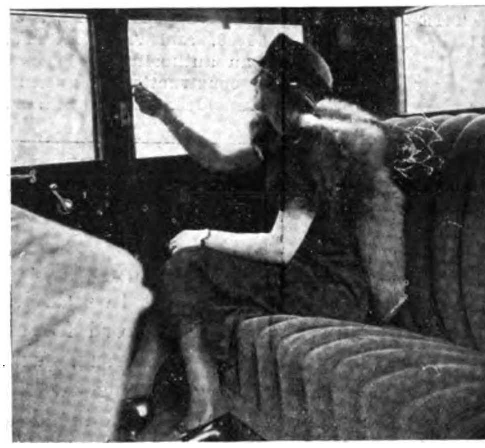
:n even a greater degree does the erior of the modern closed car bey the recognition of Milady's tastes d needs. This is particularly true both the Durant coupe and sedan well as the six sedan and coupe. :re one finds prevailing, an atmosere of genuine comfort, punctuated th all the carefully worked out dels of equipment which contribute adily to the enjoyment of travel and satisfaction of ownership. Deep, thickly upholstered seats with arm rests on each side in the tonneau, corner lights, broad windows with platinum finish regulators and silk shades are a few of these requisites for the comfort and convenience of the occupants.

The four-cylinder coupe and sedan are finished in a beautiful shade of mohair plush. The six-cylinder sedan is trimmed in a fine grade of broadcloth and the coupe in mohair velour. All models are equipped with cowl ventilators, rain visors and windshield wipers. In the six there is a ventilator in the ceiling and an extension inspection light.

Generous provision has likewise been made for storage space, not only for the little traveling necessities one always wants to carry but does not want cluttering up the floor and seats of the car, but for larger things such as grips, steamer trunks and golf bags. Under the rear deck of both the four and six coupe, which, with an auxiliary chair, seats four comfortably, is a large compartment skillfully concealed by the body lines. The four coupe is likewise built for two-passenger occupancy with one broad seat running the full width of the body. Directly back of it is another deep compartment. All models have deep, wide pockets in the doors as are shown in the illustrations.

—Courtesy Durant Standard

The Durant Four and Six coupes seat four comfortably. The auxiliary seat folds away under the cow..



All models are equipped with platinum finished mechanical regulators for all side windows.

At the left is the Durant Four coupe, below is the Four sedan.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year $2.00
Canada, one year 2.50
Foreign countries 3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIV DECEMBER, 1922 No. 9

The Industry's Biggest Year

WHEN the final figures are in for the production of the automotive vehicles in 1922 it is apparent that they will constitute a new record for the industry. December is a quiet month it is true, but the available figures to the end of November show that approximately 2,345,000 vehicles have been produced and sold so that less than 150,000 will be needed for December to carry the total to the astounding figure of two and a half million.

Actually, the past nine months have all exceeded 200,000 so that an ordinary December will carry the year's total into new ground.

This record, for it may be accepted as such in advance of the actual figures, was made in the face of many very adverse conditions. At the beginning of the year, many makers had not been able to set a production figure because of conditions. At that time, the farmers of the country, owners as a class of one-third of the vehicles in use, were not buying and there was no telling when they would come back into the market, and if they did, in what quantities they would buy.

There was much pessimism among many other classes, usually rated as large buyers. The iron and steel business was not good, and the firms in this line are large buyers of trucks. Railroads had just been through a bad year, producing many deficits, and the railroads and their materials and parts supplying firms are very large buyers of both cars and trucks.

A splendid and very successful show, with a marked trend in the direction of economy, started the year off right, and it seems as if it has continued in the same and at about the same pace right through the year.

Britons Buying Light Cars

British imports of motor cars and chassis in September numbered 1,937 with a total value of £329,169, or an average value of about £170 c.i.f. British port of entry, according to a report to the Department of Commerce by Commercial Attache Walter S. Tower, London.

Complete cars subject to duty, made up about 60 percent both of number and of total value, with 1,212 cars valued at £201,404. The average c.i.f. value for these, about £166, indicates that the light, low-priced car predominates to a very large degree. In fact it is this very aspect of motor car imports which has helped to bring about the general price cuts of British makers during the last month or two. It also has prompted several British producers to bring out new models, in the light car class, at prices which it is hoped will meet some of the competition of the more popular low priced foreign cars.

As usual Canada and the United States were the chief sources of imports, accounting for nearly three-fourths of the cars, with France and Italy supplying the bulk of the rest. For chassis, however, the share credited to France and Italy was substantially larger.

The detailed figures by principal countries of origin are as follows:

	Passenger cars		Trucks		Passenger car chassis		Truck chassis	
	No.	£value	No.	£value	No.	£value	No.	£value
Total[1]	1,212	201,404	119	22,436	458	84,349	148	20,975
Canada	559	88,978	...	....	154	21,446	9	1,222
U. S.	426	72,743	65	13,978	21	4,518	114	15,901
France	123	20,086	13	2,380	118	28,620	6	1,328
Italy	81	13,708	31	3,608	124	17,154	15	1,924

[1] Totals include other countries.

Executive Committee Meeting of C. B. N. A.

There was a meeting of the executive committee of the Carriage Builders' National Association on Nov. 22, at the Hotel Gibson, Cincinnati, O. Among the matters of importance discussed were the place of the next meeting, which will be held in Cincinnati in 1923, the time to be set later, and the decision to do away with the exhibit feature at the next convention. P. E. Ebrenz was elected chairman, succeeding A. H. Ahlbrand.

A delightful dinner was enjoyed in the evening by a number of those identified with the horse-drawn vehicle industry, as guests of Ed. E. Hughes, the new president of the Carriage Builders' National Association. While the dinner was intended primarily for the members of the executive committee of the C. B. N. A., there were some invited guests in addition to the above, and the spirit of the occasion was cheer and good-will. Those present included W. H. Roninger, Theodore Luth, F. H. Delker, C. R. Crawford, P. E. Ebrenz, Clen Perrine, R. S. Triplett, A. H. Ahlbrand, S. R. Ewing, jr., Homer McDaniel, W. C. Martin, E. E. Hughes, G. W. Huston, C. R. Rennekamp W. F. O'Brien, O. A. Timberlake, H. S. Cox, A. C. Pogue, Hanly Bohon, J. O. Bauer, E. V. Overman, J. W Allen and Ed. Trau.

Olds Men Honored in Lansing

Six of the Olds Motor Works organization qualified for places at the banquet table of the Lansing Chamber of Commerce, when on Nov. 22, it gave a dinner to employees of Lansing factories who had rendered 30 or more years of service to their employers. A. B. C. Hardy, president of the company, was among the speakers.

Ford Buys Coal Mine

Henry Ford has taken another step toward completion of his program to produce everything he needs for his business in purchasing the Dexcar coal property at Davy, McDowell county, W. Va. The price is understood to have been $1,250,000, of which $1,000,000 was cash. The mine has a capacity of 350,000 to 500,000 tons yearly.

Recent Novelties in Engine Construction

Improved Forms of Cylinder Construction and Arrangement—New Valve Forms—Modifying the Stroke to Suit Power Demand—Eliminating Ignition

IT WILL be admitted by all students of the automotive vehicle that the future progress of the industry depends in large part upon the improvements of the next few years. Inventors, designers and others now working along these lines, have, with very good reason, devoted themselves largely to engine improvements. The "good reasons" for this are apparent at a glance. It was the engine which made motor cars and trucks possible. It is the engine on which we are dependent for power and speed. Any improvement which will improve the power or speed from a given size of engine will be welcomed like a long-lost son. Similarly, the question of economy is largely a question of engine design and construction; an improved engine which would give the same power, speed and other advantages on less fuel and oil would be a marked advance, and would be welcomed by thousands. As we improve the flexibility and performance of the engine and its response to the driver's needs, we improve the facility with which the driver may operate a car or truck, and thus, widen the possible field of sale and reduce the selling resistance. In dozens of other ways, an engine of proven superiority over present-day engines would be a great thing for all those in the industry itself, for the public and business in general.

Some of the things on which inventors have been working recently and which will be shown and described on these pages are: Cylinder construction and arrangement to the end of saving space, valves and valve operating methods, and eliminating the ignition apparatus, wiring, etc., through provision for self-ignition.

Very Short Engine

The first of these novelties refers to the new Lancia engine. In this, the V-type of construction is used with a very small angle between cylinders. To go with this, the cylinders are staggered. This arrangement, the length and width are both cut down to the smallest possible dimension, the designer achieving two-cylinder length and width in a four-cylinder engine, and four-cylinder length and width in an eight-cylinder engine.

The description which follows concerns the four-cylinder model only, and this is shown in the drawing, Fig. 1, but at the Importer's Salon in New York recently, the same idea, the same design in fact, extended to an eight-cylinder engine was shown. The four-cylinder unit develops 50 h.p. and has a length of but 22 in., over flywheel and fan. The cylinder block measures but 16½ in. Figures are not available for the eight but obviously in the same cylinder dimensions (2.9 x 4.7), the overall length would be considerably less than twice that of the four. Assuming for the sake of argument that the eight-cylinder unit measures but 38 in. over all, and that the power output is double that of the four, that is, totals 100 h.p. What other known car has a power plant of this ability with anything like this compactness?

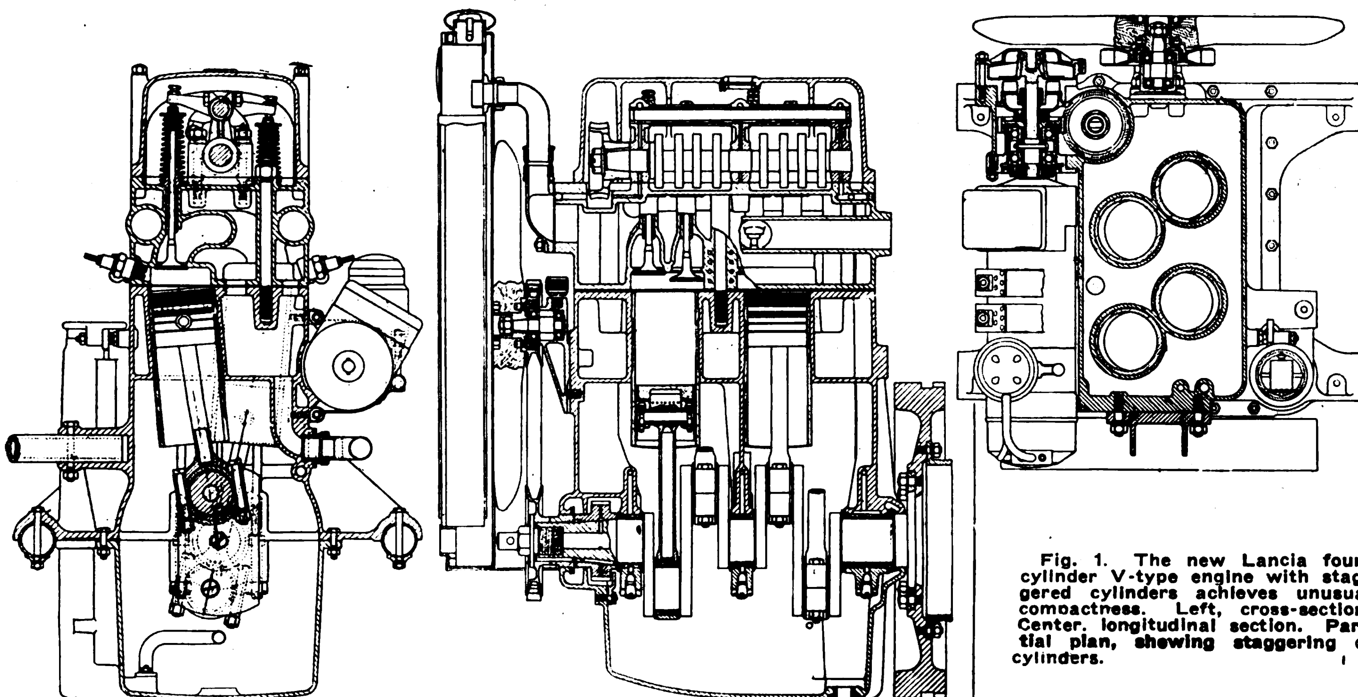


Fig. 1. The new Lancia four-cylinder V-type engine with staggered cylinders achieves unusual compactness. Left, cross-section. Center. longitudinal section. Partial plan, showing staggering of cylinders.

The big saving comes in the new and novel arrangement of the whole power plant. The clutch and transmission, united with the engine as a unit power plant are forward under the hood, which because of the unusual compactness is no longer than the ordinary car of this power for engine alone. By raising the hood, access is had to this complete unit, not to engine alone as is the case of all other cars.

The engine used on this new Lancia is a four-cylinder V-type with an angle of 20 deg., a 2.9 in. bore and 4.7 in. stroke. This arrangement of cylinders is covered by patents and is a type which has been in production for two years on the 8-cylinder Lancia. In addition to forming a V, the Lancia cylinders are in staggered relation. This

disposition avoids the use of forked connecting rods and gives a separate bearing for each rod, as in conventional construction. The crankshaft, which has a diameter of 2.1 in., is very short and is carried in three plain bearings, the lengths being 1.29, 1.29 and 2.55 in., respectively. Circular webs are used on the crankshaft.

Cylinder barrels are of close-grained grey iron, cast separately with a flange on the head. After receiving a first machining operation the barrels are set in the mold and have the aluminum water jacket and crankcase cast around them. A detachable cast iron cylinder head is used. The vertical valves have an external diameter of 1.6 in., and are operated by an overhead camshaft and rockers. The drive is through a vertical shaft and spiral gearing, the shaft being in the forward portion of the cylinder casting. The valves are closed by pairs of concentric springs. The connecting rods are tubular with white metal split bearings held in the usual manner by two bolts. The aluminum alloy pistons have considerable metal in the head, very thin skirts, and are fitted with three steel compression rings having a depth of only 2 mm. Below the compression rings there are two scraper rings. The wrist pin is fixed in the piston and turns in the rod.

On the left side of the engine there is a neat arrangement of water pump and combined Bosch generator and distributor. Only the oil filler and breather are placed on the right-hand side of the engine. A wood airplane type propeller is driven by belt from a pulley on the crankshaft. The position of the Zenith carbureter is unusual. It is bolted up direct to the rear face of the cylinder head, between the two exhaust ports. As shown in the illustration, the exhaust manifold is swept to the left and then carried to the rear in the normal manner.

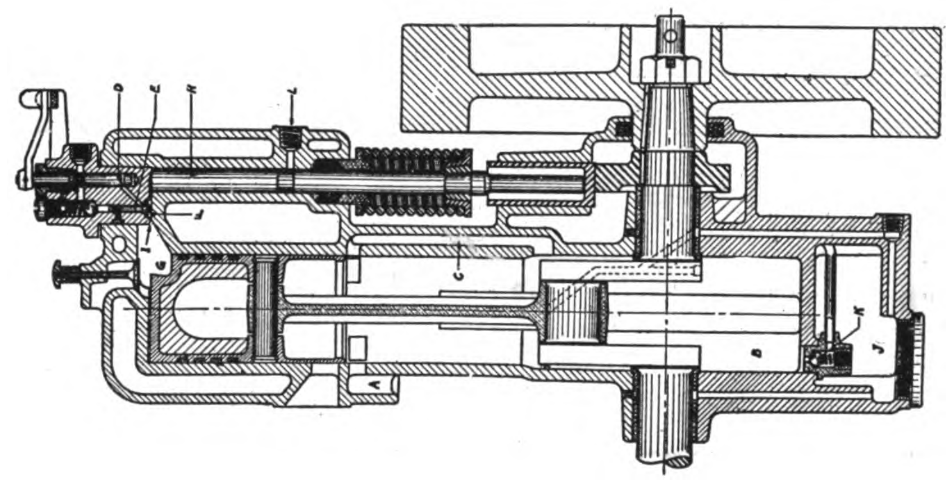


Fig. 2. Sectional view of new Stenger combined poppet and sleeve valve engine.

Combined Poppet and Sleeve Valve

Another new development which promises much is the Stenger valve, shown in Fig. 2. As will be noted in this illustration, the valve layout consists of a single poppet valve A, shown in the cross sectional view, carried in a cage B, which also acts as a guide for the sleeve valve C. This cage is in reality the cylinder head and is held in place by the nut D threaded into the cylinder block. The poppet valve is operated in the conventional manner by the rocker arm E. The sleeve is operated in much the same manner by two parallel rocker arms F. The inlet and exhaust ports are shown by G and H respectively.

Among the claims made for this valve layout as compared to conventional types are the following: A gain of 20 deg. on the full opening period of the inlet port; greater ratio of valve area to the cylinder volume with consequent less throttling of the incoming and outgoing gases; low ratio of flame swept area to cylinder volume. The valve is readily accessible for cleaning and repairing, and there is said to be relatively even temperature for the cylinder walls and valve.

The curves shown in Fig. 3 were taken from average runs on a single-cylinder 4 x 5¾ in. engine. The fuel used in the tests was ordinary commercial gasoline.

All the working parts of the engine are enclosed and work in a spray of oil. From the sectional view it will be noted that the valve guide is made in such a way as to permit the introduction of water from the cylinder jackets to assist in keeping the valve cool. This is an important matter in this case where the single valve assumes a large diameter.

The entire valve mechanism can be removed in about 10 min. and one cylinder of a multiple can be repaired without disturbing the others. The threads on the member which holds the cage in the cylinder block are quite coarse and inasmuch as they never are subjected to the heat of the explosion they are not likely to stick.

Varying the Valve Operation

Another plan used to increase engine power in airplane engines is to provide a variable inlet charge cut-off by altering the timing of the inlet valve. This may be done in various ways, one simple method being shown in Fig. 4, upper part. This design calls for operating the valves by means of rockers mounted on eccentric pins. By rotating on its housing H and eccentric E which carries the swivel pin S, the clearance C between the rocker R and the valve is altered and the valve lift and duration of opening is modified, thus effecting the inlet charge cut-off.

Engine power may also be varied to suit the needs by the use of an adjustable cylinder or combustion space. Also, the variable stroke method has been proposed. The design of a variable stroke engine of the multi-throw type of crankshaft presents mechanical difficulties. It is, however, comparatively simple in connection with radial engines. Thus, Fig. 4, lower part, shows the design of a radial power recuperating engine.

Over the crank pin C is fitted an eccentric sleeve D, which carries the connecting rod A mounted on ball bearings in the usual manner. The eccentric sleeve can be rotated partially round the crank pin and held in any desired position. It is obvious that by this arrangement the stroke of the piston can be altered at will. Only a small eccentricity is required to give the desired result. Even in the extreme case of group 1, to which the curves relate, an eccentricity of 5 percent of the shortest stroke is all that is necessary to effect power recuperation up to 20,000 feet.

In order to operate this eccentric sleeve from outside, a gear wheel B is attached to the sleeve. Into this gear meshes another wheel E carried on the spindle F, the latter being provided with a multi-start quick thread as shown. A sleeve H with a corresponding internal thread

engages the thread of the spindle F. This sleeve is prevented from rotating by one or more keys G lodged in the crankshaft in such a manner that an axial sliding motion can be imparted to the sleeve H by means of the lever I. It will be seen that by operating the outside lever K, which is coupled direct with lever I, the eccentric sleeve D can be rotated to any desired position, and maintained there while the crank is revolving, modifying the effective throw of the crank and thereby the piston stroke.

As the eccentricity is very small, the reaction of the connecting rods while under load on the eccentric sleeve is small, and no undue force would be required to operate the mechanism while the engine is running. Should there be any difficulty, however, the throttle may be closed for the short period of the change, which would be effected in hardly be necessary. For the same reason the dif-portioning the lead of the multi-thread and the levers correctly, this process of operation would steps according to the altitude. However, in pro-ferent positions of the eccentric affect the timing of the engine only to a small degree, and it should be possible to design a case so that a satisfactory timing for all altitudes is arrived at, or such a timing may be evolved which gives the best result at the altitude at which the engine is called upon to run normally.

Super-compression Displaces Ignition

Another very recent form of engine which appears to possess merit is one in which the ideas back of the Diesel engine are used, with the thought however of producing simplicity and the elimination of parts and units now considered troublesome. That is, by super-compression and fuel injection, the entire ignition apparatus is eliminated, this arrangement bringing about self-ignition so that no parts or units are need for this purpose. The engine is to be introduced and exploited by Vincent Bendix, president of the Bendix Engineering Works, Inc., of Chicago, whose identification with the Eclipse-Bendix drive, employed in connection with the

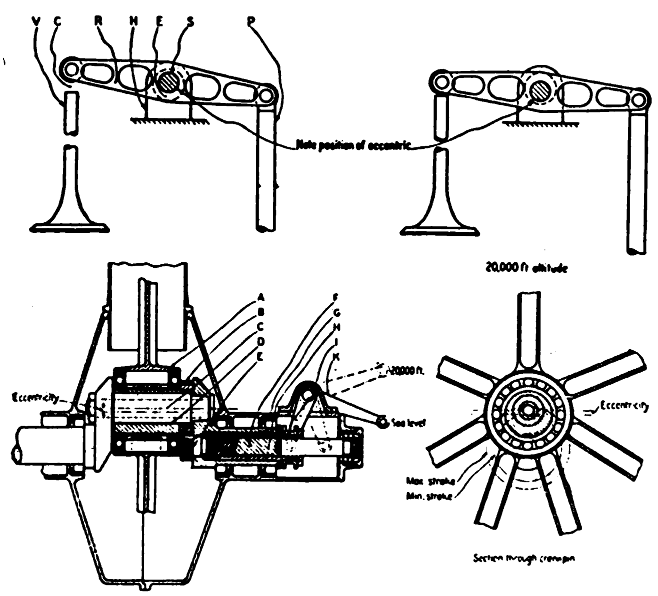


Fig. 4. Above, valve operation of Atkinson cycle power recuperating. Below, radial power recuperating engine.

electric starters of approximately 95 percent of all American automobiles, has made his name almost a household word.

The Gernandt engine, as it is known, embodies the novel principle of compressing small quantities of the exhaust products of combustion, by which the fuel is atomized and with which it is injected into a compressed charge of pure air. Vaporization is promoted by the heat of the exhaust, while compression carries the mixture up to the ignition temperature. The engine thus becomes self igniting.

Because of its operation, the engine requires no electrical ignition appliances, such as magneto, battery, coil and spark plugs. Furthermore, such good use is made of the pressures developed within the engine itself that auxiliaries such as fuel pump, lubricating pump, and so on, are entirely obviated. The unit thus becomes exceedingly simple and is entirely self contained. Coupling up into mul-

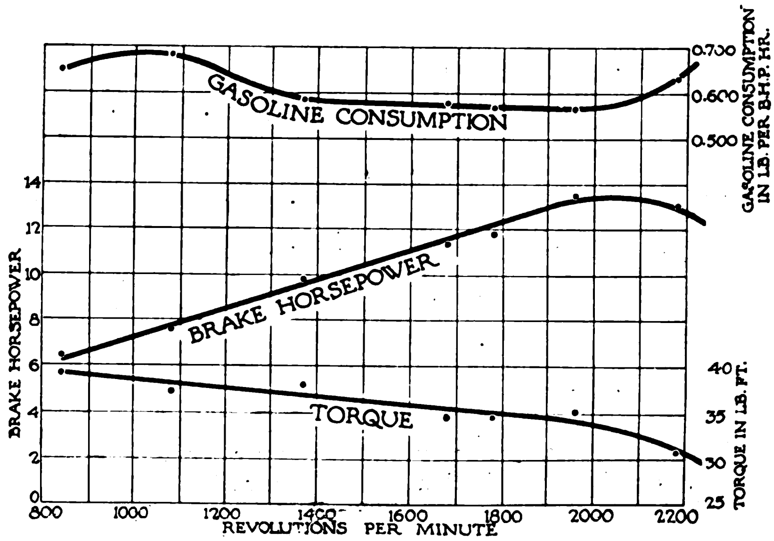


Fig. 3. Power torque and consumption curves of Stenger engine, from Armour Institute tests.

ti-cylinder units follows naturally, and so far as experiments have indicated, with absolute success.

Units have been built in single- and multi-cylinder forms, both two cycle and four cycle in operation, and in both water- and air-cooled forms. In each case the operating principle and injection mechanism is the same. It has operated on gasoline, kerosene and distillate. It is said there are possibilities of using heavy oils for fuel.

Operation of the engine may be readily described by the aid of the illustration, Fig. 5. The two-stroke type is pictured. Pure air enters through the air inlet port A into the crank chamber B, and by-passing it through air by-pass port C into the cylinders when the piston reaches its point of lowest travel, at which time fuel is metered through a suitable regulator D and a check valve E, and deposited in a small pocket F between the combustion chamber G and the injection plunger H by means of a combination of suction and a slight pressure maintained on the fuel tank.

On the upward stroke of the piston, the by-passed air is compressed to a pressure of about 350 to 400 pounds per square inch, at which time the fuel is injected into the combustion chamber G. During the compression stroke the fuel becomes heated and pressure rises in the fuel pocket F which is in direct communication with the combustion chamber G through the spraying slot I. When the piston nears the top of its compression stroke the products of combustion previously trapped between the spraying slot I and the injection plunger H, are super-

compressed by means of a small plunger H and forced through the fuel pocket F and spraying slot I into the combustion chamber G, carrying with it the fuel in a thoroughly atomized condition.

As the products of combustion, with which the fuel is compressed, contain no oxygen, combustion is impossible until the fuel charge is mixed with the charge of compressed air in the cylinder. At that point, however, it becomes self igniting.

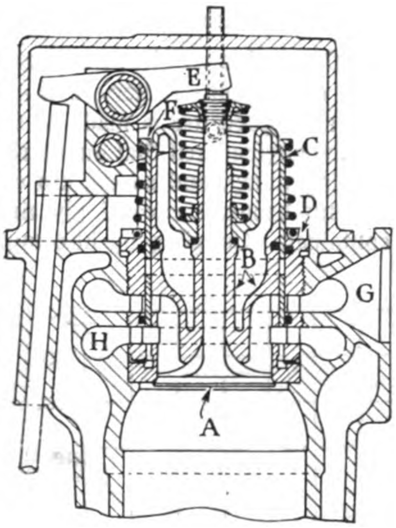


Fig. 5. Cross-section through the Gernandt ignition-less engine.

Fuel feed, injection and rate of injection are mechanically timed so that the engine functions uniformly throughout its speed range. This, by contrast with other types of engines embodying the super-compression idea, has proved astonishingly wide. A speed range of 200 to 2,000 revolutions has, in fact, been maintained with the small, single-cylinder unit, it is asserted.

Features indicating the thoroughness with which the development work has been carried out are embodied in the fuel and oil feed. For example, pressure from the cylinder, in which the injection plunger works, is carried to the fuel tank, thus obviating the need of a special fuel pump. In the same way, air pressure from the bottom of the crankcase is employed to feed lubricant to the moving parts.

Other similar constructional novelties of very apparent worth will be described subsequently.

Exceeding the Saturation Point in Selling

Continued from Page 18

ment so that each job went forward with the least complaints. We improved also the handling of our customers by doing away with the attitude of utter disregard which was so prevalent in 1920. Each salesman was especially coached to treat every prospect that came up as if he were going to buy the fullest amount of goods. Every department was told that each new customer made it easier to continue a man in his job; and also, that this meant the continuation of the company."

This policy, so obvious that it should be used almost universally, is all too seldom found. Obviously, no matter how much the demand is diminished, it will be increased as the product gives greater value for the price. Similarly, granted that the other circumstances surrounding it are equal, that product will least feel the diminished demand which has established itself as the outstanding value in its field. As has been already pointed out, some demand always exists; some people make money in any turn of the market whether up or down, and they alone constitute a source of demand which will flow to the product with the reputation for being good value. Thus is it possible in times of plenty to prepare against the lean years which may come.

By their failure to study how nearly they have come to making their products as good as they possibly can be made, many business men are overlooking a sure-fire way to increase sales in the face of strong-resistance, believes George H. Hannum, president and general manager of the Oakland Motor Car Co. He believes, from his experience, that the public has an almost uncanny knack of sensing values. He tells, of his own company:

"Every cent we save through economy of operating and material expenses we place right back in the car. For while it is true that the public may want a good car at a low price, you may be sure that the foremost consideration is to get a good car.

"Our policy is to build a sound product, sell it at a low margin of profit and tell the truth about it. That this policy has borne fruit is indicated by the fact that we have completed one of the most successful years we have ever enjoyed."

When he was asked how his concern had suddenly begun to operate at top capacity after a shut-down more than ordinarily long, the president of a machinery company, who requested that his name be withheld, declared: "It was simple, when we got the right idea. All of our possible customers had been loaded to the guards with our machinery which they used in manufacturing during the boom. When demand for their products fell off, they had a surplus of manufacturing capacity—and our machines were part of their surplus equipment. It looked as though we could not sell anything for the next five years. There was enough of our equipment, in first-class condition, available on the used machinery market to supply the demands arising from normal factory expansion for that period.

"But I had had in the back of my head for a long time the beginning of an idea for making our machine more efficient. Like most managers, I had for several years been so busy turning down orders from would-be customers that I had not found the time to develop this improvement. If I had looked far enough ahead, I confess we should not have had to shut down the plant more than a month.

"Well, we got busy developing this idea. We worked it out a good deal further than we had at first thought could be possible—and the resultant machine turns out 150 percent the capacity of the old machine, at no greater operating cost. You can see how that would reduce costs on the operation our machine performs in a plant.

"Everybody in the manufacturing field was looking for a way to cut costs. Our new machine provided it, and left all of our own and our competitors' previous models high and dry. They became obsolete, and our new machine became the standard. Result: We are working night and day trying to meet the demand—and, every week, see our production falling further behind our orders.

This is the same policy which has enabled a manufacturer of business equipment to keep selling larger and larger numbers of his products every year, in fields which have been combed for 30 years by his sales department, one of the country's most intensively organized sales departments. His invention and development experts have kept bringing out products sufficiently better so that it has paid the owner of an equipment perhaps five years old to scrap it and replace it with the new model.

When a new model is sold it is the best that has been developed. But the horizon broadens, the manufacturer sees a bigger usefulness for his product—and since he be-

gan his intensive selling he has probably produced as many of his machines as there are business establishments in the world.

The same urge to keep bettering the product may be seen behind the statement of George Briggs, president of the Automatic Screw Machine Products Corp. that an increase of more than 50 percent in the capacity of the old product helped increase sales in a sluggish market. And he says, further:

"We do not make any grants of territories to the local distributor, but rather ingeniously pay him for the services he renders us by confining his commissions to the sales that he initiates. This adds no further burden to our sales price, in fact, decreases it when we add another link in the chain of distribution.

"To increase our foreign sales we have designed new instruments that more closely resemble what the foreign user is accustomed to. To overcome the foreign buyer's antipathy for purchasing imported product, we are having some parts manufactured in the country in which the apparatus is sold."

The discovery of new uses and as a result new markets has played an important part in keeping the sales volume of the Vitrolite Co. climbing. A decrease of about 15 percent in price has been put into effect within the last two years, but the annual sales volume of the company is today four times that of five years ago.

The introduction of the product into a new field is made by talking service and not material. In the textile field, for example, it was sold extensively for the tops of inspection tables because the white table top made it easy for the employes to find defects in the dark fabrics. As soon as a new use is discovered it is exploited generally."

And, oftentimes, the shrewd manager finds his only option is to sit tight and let the other fellow do the "shaking down" for the whole line. Especially is this true when the industry has suffered from an excessive overexpansion in the form of new concerns entering, without the right know-how and backing, in the hope of getting some of the "easy profits." Something like that happened in the talking machine industry.

And George E. Brightson, president of the Sonora Phonograph Co., Inc., tells how he is meeting the condition: "It is simply a question of maintaining the dignified selling policy that belongs to a high-class product of the musical art. Because of an overproduction, invited and created by an abnormal demand during the war period, thousands of speculative or nondescript machines were manufactured and disposed of to the public. Some were experiments—others made by companies formed with an effort to obtain a place in the trade, aggregating in all many thousands of phonographs.

"This flood of merchandise for awhile wrecked the public confidence, and temporarily stopped to an extent normal purchasing on the part of the general public, and from now on it will be difficult to sell other than machines of high quality. The public has had its lesson, and price will not attract—it must be quality."

When sales resistance crystallized in its market, the Upson Board Co. went about binding to it even more tightly its dealer organization. "We have always made a quality wallboard sold at a higher price than competing boards," explains Charles Upson. "To meet the competition of price the company has concentrated its efforts on maintaining close contacts with its dealers. As a result the 'Upson family' has grown up and all correspondence with the dealer is based upon the conception that the interests of dealer and company are mutual.

"This is an underlying policy that we follow consistently in every transaction. When settling complaints, we practically always give the customer exactly what he claims, for experience has shown that if our desire to deal fairly is once established, the customer will himself be guided by the same spirit of fairness.

"That it pays to adhere consistently to such a policy is shown by our sales records. We turned the difficult year of 1920 into a protfiable one, with the largest sales in our history. More than that, the year 1921 was far and away ahead of 1920, while 1922 is gaining over 1921 by a large percentage."

So, without question, it is possible to sell profitably—even in a "saturated market." Some way can be devised, as the experience of this group of concerns surely indicates.

Body Engineering Sessions

Two body engineering sessions will be held during the annual meeting of the Society of Automotive Engineers. The meetings will take place during the week of the automobile shows in New York City, the exact dates being Jan. 9 to 12, inclusive.

The first body session will be held on Tuesday afternoon, Jan. 9, at 2 o'clock. L. V. Pulsifer of Valentine & Co., will read a very comprehensive paper on the testing and application of automobile body paints and varnishes. Mr. Pulsifer is planning to set up laboratory equipment in the meeting room with which he will demonstrate many of the tests which body engineers should be familiar with. Mr. Pulsifer has been in charge of searching investigations into the causes of paint deterioration, cracking and peeling and is therefore able to give the body engineers some very valuable information. The second paper will be given in this meeting by F. F. Murray, advisory mechanical engineer with the Hardwood Manufacturers' Institute. on the needless waste of hardwood lumber. The organization which Mr. Murray represents is cooperating with the S. A. E. and Automobile Body Builders Association in creating lumber standards and specifications which will avoid lumber waste and conserve the country's supply of hardwood.

The second body engineering meeting will be held on Wednesday afternoon, Jan. 10, starting at 2 o'clock. Geo. J. Mercer will read a paper describing some unconventional departures in the construction of closed automobile bodies. The design has been worked out with the idea of building a body with complete enclosure at a nominal price. His paper will arouse considerable discussion since the features of this body are such a great departure from past practice. The second paper will be read in this session by a representative of the Studebaker production department and will set forth methods of testing top materials and artificial leather.

Both of these meetings will be held at the Engineering Societies building, 29 W. 39th street, New York. All body engineers, body draftsmen and men interested in body construction are welcome and a large attendance is expected,

Advance provisional figures show that there were 293,770 passenger cars and trucks and 42,864 motorcycles in France last year.

Sending the Highway to School

(Continued from Page 11)

are also bearing the other taxes common to all citizenship.

Forty percent of the cost of construction of the higher type of highways is permanent in character, as for example: drainage, location gradients. Therefore, it seems unreasonable to ask the people of the present decade to meet the entire cost of such construction.

Dividing Highway Costs

Therefore, as general principles we contend:

(1) That all highway expenditures should be divided just as railroad expenditures are, into two classes, capital outlay and current expenses.

(2) Since capital outlay is a permanent investment it should be paid for from the proceeds of long term bonds, and since highway construction is of benefit to all, the interest and amortization charges for such bonds should be paid from general taxation.

(3) Current operating expenses naturally include all the costs of keeping these highways in first class condition. Everybody should pay some part of this maintenance cost through a general system of taxation, but the higher assessments for maintaining the highways should be borne by motor vehicle users and by agricultural and urban property owners whose valuations are enhanced by highway improvements. The proper ratios can be ascertained only by detailed study.

Just in this casual glance at the problems of finance that stand in the way of highway expansion, I think I demonstrate the need of men trained in revenue questions.

Our fourth great necessity calls for legal specialists.

The college that will turn out authorities on the subject of highways and automobile legislation, will confer an immense boon to the country.

At the present time the legislatures of 48 states are working on varied highway enactments.

Some of the provisions are wise. Some of them are unwise, despite sincere and painstaking efforts to get right results.

In most cases the failures result from the lack of adequate data.

There are lots of subjects to which the expert in highways legislation can direct his attention, even after the question of finance has been eliminated.

Legislators can render a great service in working out uniform regulations of motor transportation.

A centralized control, preferably by each state, will remove many local evils, and hasten progress.

State enactments should as quickly as possible be brought into accord with each other and with federal enactments.

The proper regulation of the increasing volume of city traffic daily becomes more difficult.

Against Reckless Driving

Our industry cannot register too strongly its opposition to overspeeding and overloading.

It will welcome any program that will safeguard pedestrians, particularly children.

At the same time, the motor vehicle as a medium of great public service must be reasonably protected in its rights.

There is also the great issue of the regulation of motor vehicles as common carriers so that they and other mediums of transportation may not suffer unfair competition.

Assuming that this becomes inevitable it should be friendly to highway transport and not punitive.

It should protect the rights of road users and prevent abuses.

The expert on highway enactment will find plenty of call for his services.

There must also be trained transportation experts who can tell where traffic should properly be allocated. This is the fifth kind of a specialist you can develop.

These men can find clients in all lines of activity.

They will make investigations and advise great manufacturers and merchants where and when they should use railroads, steamships and motor trucks.

They can also be of help to the farmer in advising him as to the best means of reaching his market, having in mind all questions of perishable product, seasonable demand and cost of delivery.

Transportation is so large a factor in the cost of products that it is not difficult to estimate the service that trained experts could render.

Somewhat related will be the traffic expert who will assist in city planning.

The real estate man is intimately concerned, perhaps more so than he knows in the results or the new relationship between the highway and the motor car.

He forms the sixth essential kind of highly developed expert.

Those who think of the automobile merely as a "pleasure car" have perhaps never contemplated what a terrific real estate upheaval there would be if the car and truck should suddenly be withdrawn.

The Automobile and Real Estate Values

The evil consequences resulting would affect both city and rural population.

It will be found by analysis of living conditions in any great city that its central portion is more and more given over to commerce and manufacturing, and that the residence section constantly moves further into the suburbs.

The man of wealth and the man of only modest means find that the automobile gives ready touch with the heart of the city.

They ever have at hand a medium of individual transportation.

The man with $50,000 in his suburban home, or for that matter the man with only $5,000, will not jeopard that investment for the price of an automobile. So will the farmer decline to sacrifice the vehicle that connects him with his market.

Therefore, the automobile and the motor truck actually constitute a kind of real estate insurance.

There must be studies of how real estate values are increased by contiguity to improved highways. This is destined to be one of the big subjects of the future.

I have endeavored to suggest the kind of men we need for this work. Those who enter it will find forceful cooperation from the government, for through the splendid efforts of the War Department, the Bureau of Public Roads and the Highway Education Board, Washington has powerfully testified its interest.

This is important for the subject looms big with respect to our national future.

I never fear for our country.

The country is all right. The question is, are we big enough to develop it?

Our institutions have proved their stability in a century and a half of test.

In that interval only ourselves, England, Japan and Denmark have escaped changes of government by revolt from within or conquest from without.

Our progress has been so great, so solid and so rapid that pessimism is confounded.

It is true, of course, that we have a national debt.

This amounts to twenty-four billion dollars, of which ten may be offset by the obligations of foreign governments to us.

But even assuming that these debts never should be liquidated, we have ten times as many assets as liabilities, for our net worth is estimated at not less than two hundred and twenty-five billions of dollars, some economists placing it as high as three hundred and fifty billions.

We are accused of being extravagant, and yet during the world war we absorbed twenty-two billion dollars' worth of loans, and withdrew from European possession six billion dollars' worth of American securities previously held there.

This means that our people saved in that period the unprecedented sum of twenty-eight billions of dollars.

With about 5 percent of the world's population, we own or control 24 percent of its agricultural production, half its gold, half its copper, half its petroleum, half its pig iron and half its steel products.

We make one-third of its shoes, and one-fourth of its linens.

This glance deals only with achievements and not with possibilities.

The great undeveloped west holds untold resources.

In the state of Arizona alone, 300,000 persons are living on 100,000 square miles.

Only irrigation and highways lack to create an incredible addition to our wealth, and to bring the necessities of life more readily and more economically within reach of our people, no matter how great our increase in population.

New Force Given Ancient Alliance

In forwarding highways development, the educator gives new force to an ancient alliance. Sentimentally and historically the highway has great claims upon him.

Since colonial days the destinies of highway and education have been linked.

The little red schoolhouse is our greatest and most distinctive contribution to world progress.

There have been other republics, other constitutions.

The Magna Charta served the cause of liberty five and a half centuries before the Declaration of Independence, but we were the pioneer nation in making education democratic, in equalizing opportunity for the offspring of rich and poor.

When the settler had blazed his trail through the forest, he built the rude schoolhouse. Ignorance has had no more relentless foe than this combination. The humblest road leads finally to the school house. The two have been the Damon and Pythias of learning. Except for them there might have been no Lincoln.

Now the schoolhouse is outstripping its colleague.

Much road mileage remains primitive but the homes of education have undergone a transformation.

The little wooden shack has become the great stone palace of study.

Worthy structures have multiplied in all sections of the land. The smallest county boasts its fine high school. If there be but one worthy edifice in a community it is usually dedicated to education.

Gentlemen, for the good of us all the highway must not be permitted to lag. It must keep pace with the school, so that the union of the two, freed of politics and both intelligently administered, may render its priceless service to the nation.

There could be no higher aspiration, no more dignified career, no better citizenship, no more practical patriotism, than to strive for this result.

Editor's Note—The group of concrete road pictures on these pages is typical of the charming landscapes afforded by the varied topography of New York state. This commonwealth was one of the pioneers in providing good highways. It is now possible to reach almost any part of the state by means of a good road, but there are yet many miles to be paved, widened and straightened.

The improvement of the highways has developed traffic to a point far beyond the imagination of the early road builders. It has required the united efforts of state and county highway officials to provide the durable roads required for this traffic.

Concrete highways are prominent in the types selected for the heavily travelled roads. Up to Aug. 1, this year, the equivalent of 2,000 miles of concrete 18 ft. wide had been completed or placed under contract.

Forty Thousand Cars in New Zealand

There is no such system in New Zealand for registering motor cars as prevails in the United States. Each district has its own registering authority and the registrations run from the beginning of motoring to the present day. The following estimate by Consul K. de G. McVitty is conservative and as nearly accurate as it is possible to obtain. There are about 40,000 passenger cars in the country, 9,000 of which are in the Auckland district. About 10 percent of these cars require a straight side tire. Dealers' estimates vary widely as to the percentages of cars using metric and inch clinchers, but the general belief is that the metric clinchers are more common. A very few American-made passenger automobiles are still being brought in on metric clinchers. Of the estimated 5,000 motor trucks in New Zealand, about 1,000 are in the Auckland district. About 25 percent of the truck tires used are pneumatics. American makes of tires are most popular, followed by French, English and Australian makes.

New Name for Carriage Makers' Club

The name of the Cincinnati Carriage Makers' Club has been changed to the Carriage, Auto and Accessories Club. The decision was reached at a meeting of the organization held at the Grand Hotel on the evening of Nov. 21. A letter had been previously sent out to the members for suggestions in connection with the matter, it having been discussed for some months before by members. The replies favoring the change in name were much in excess of those opposing any change, and the decision was made unanimous at the above noted meeting of the club.

Handling Material in Automotive Plant

(Continued from Page 15)

usually quite able to account for the goods. All scrap and salvage is disposed of within the storerooms. This is done to replace it with good stock, and get a good record on the disposal of the scrap. In many of the assembling operations, the work is done on a continuous moving conveyor, in which event, the stock is put up in single sets and moves along with the assembly.

The final car assembly is on this basis. All parts for the car, with the exception of axles, frames, motors, and body, are assembled on the racks in the storeroom, which has a complete floor in this case, located over the final assembly department. This assembling of parts on the rack is done as the rack moves on a power driven conveyor past the point of storage. The rack, when filled, is carried by crane to the final line conveyor, which comes up into the storeroom on the second floor, and then carries the rack back down at an angle of 45 deg. When material is put up in single sets, as in this case, all nuts and washers are assembled to bolts and sent to the assembler in this manner to prevent his reaching first for the bolt, then for the washer, and then for the nut.

The finished unit assemblies, as motors, axles, etc., are handled to the final assembly storerooms by tractor in train loads on a scheduled basis. This is the only operation in the plant where parts are handled by the tractor from one floor to another on elevators. Specially designed racks to suit the need, assembled on standard 3 x 6 ft. trailer trucks, are used for transporting these units.

Tractors and Box Trucks Handle Rough Parts

All forgings, gray iron and malleable castings, stampings, aluminum castings, and for a considerable number of parts, bar steel and tubing, are handled in what are called rough stores. This material, on a basis of 200 finished automobiles per day, is handled by three electric tractors, which on their routes also handle finished machined parts to stock. There are about 3,000 box trucks of three types, and 400 flat four-wheeled trailer trucks of one type only, that are used for storing material as well as for transportation. The transportation of this material is all on the ground floor. The stock is loaded in specific types of trucks on the receiving dock when received. Specific amounts of all material is placed in each truck and tag is then placed on truck showing part number and quantity. The box truck used is made on the same principle, size only being the variation.

As stated, there are three sizes, the first being 40 in. long and 26 in. wide, with sides 18½ in. high; the third, 48 in. long and 34 in. wide, with sides 26 in. high. The same part and the same quantity always are stored in rough stores, or as it may be called, semi-finished stores, in the same type of truck. Two wheels and an axle are used on each truck. A clevis with pin is attached to the tender of the rear end and a cast steel leg for support is used on the front under which a third wheel can be inserted with a fulcrum movement, thereby putting the truck on wheels and ready to roll. This third wheel is used in two types, one having a long handle for hand operation, and the other having a short tongue for trailing purposes. The trucks are balanced so it is unnecessary to insert the third wheel for short pulls of a few feet.

(To Be Concluded)

New York Show Events

Jan. 8—Convention, National Automobile Chamber of Commerce export managers, Marlin-Rockwell building.

Jan. 8—Dinner, Rubber Association of America, Waldorf-Astoria.

Jan. 9—Meeting, National Motor Truck committee.

Jan. 9—Annual dinner, National Automobile Chamber of Commerce, Commodore.

Jan. 9-12—Annual meeting, Society of Automotive Engineers, United Engineering Societies building.

Jan. 10—Directors' meeting, National Automobile Chamber of Commerce, Marlin-Rockwell building.

Jan. 10—Sales conference and luncheon, Franklin Co., Commodore.

Jan. 10—Meeting-dinner, eastern Oldsmobile dealers, Commodore.

Jan. 10—Dinner, Motor Accessory and Manufacturers' Association, Commodore.

Jan. 11—Dinner, Society of Automotive Engineers, Pennsylvania.

Jan. 11—Luncheon and meeting, Hupmobile dealers, Commodore.

Jan. 11—Luncheon, New York State Automobile Merchants' Association.

Bureau of Standards Studying Tail Lights

A series of tests is being conducted by the Bureau of Standards of the Department of Commerce in cooperation with the Society of Illuminating Engineers, the object of which is to make automobile license tags legible at night. It is hoped, the Commerce Department says, that as a result of these tests it will be possible to establish a practical standard of illumination for these tags, so that they will be readable at a reasonable distance at night as well as in the daytime.

The tests are made by mounting the tag at a known distance, turning on the light, and seeing if the observer can read the number correctly. If he hesitates and corrects himself the tag is taken to be illegible under those conditions, as under normal road conditions there is no time for a close examination. A number of employes of the bureau are used as observers to get an average result

In the first test the tag is illuminated by lamps so arranged as to give the best possible readability. This establishes a standard. It is then possible to compare this ideal condition with the actual illumination given by any tag illuminator now on the market, to see how much they fall short, and to suggest ways in which they might be improved. The apparatus also permits of various angles between the surface of the tag and the light and the eye. The best angle at which to mount the tag can therefore be determined.

A comparison is being made of the relative readability of different color combinations. It is well known that certain combinations are more easily read than others and it is hoped as a result of these tests to give some definite data on this subject.

One curious result of these tests may be mentioned. As the numbers are raised and cast shadows, it was expected that a white number on a dark background would be more easily read than the opposite combination. Experiment showed, however, that the dark letter on white was much more easily read. This is probably because the large expanse of light enables the eye to see more distinctly.

Coding System of Numbering Steels

As a result of the decision of a conference of the principal producers and users of steel held at Washington, D. C., on Dec. 6, at the call of the American Engineering Standards Committee, designation of kinds or qualities of steels by code numbers, each of which would represent a definite specification, will be developed. The conference recommended that this code be developed under the procedure of the A. E. S. C. and suggested to that organization the appointment of the Society of Automotive Engineers and the American Society for Testing Materials as joint sponsors.

After a spirited discussion concerning the necessity for and practicability of a numbering system the agreement to go ahead with this project was arrived at. Strong opinions in favor of the proposition were voiced by heavy buying interests, such as the U. S. Navy Department, the Electrical Manufacturers' Council, the Society of Naval Architects and Marine Engineers, the U. S. War Department and the Federal Specification Board. Opposition to the inclusion of tool steel was voiced by tool steel makers. As against the claim that the numbering of steel is not desirable so far as tool steel is concerned, it was brought out by a representative of the Navy Department that the navy now has an accumulation of a million pounds of unidentified tool steel, all of which must be analyzed and tested before it can be used. This condition, it was said, would not exist if the quality of steel was designated by code numbers.

The conference voted that it is desirable to have a uniform numbering system, based on specifications, for forging steels, casting steels, structural steels including plates, tool steels, and other steels, this decision with the exception of tool steels being taken without dissent. Whether the basis for such a numbering system should be chemical composition, physical properties, or heat treatment was left to be determined by a sectional committee, which is to be approved by the A. E. S. committee. It was also left to the sectional committee to decide whether there are any existing systems which can be used as a basis for numbering codes for any or all of the various groups of steels. The question of whether brand names can be accommodated to and associated with a numbering system was brought up, but the consensus of opinion was that this is not practicable.

Car and Truck Output for 11 Months 2,344,000

Motor vehicle production reports presented at the December directors meeting of the National Automobile Chamber of Commerce show the total output for 11 months of this year to be 2,344,000. This exceeds the record full year's business of 1920 which reached the mark of 2,205,000.

November output of 232,000 cars and trucks was within 5 percent of October, and was twice the volume of the same month last year. In 1921 November business was 26 percent under October.

This prevalence of low priced models of closed cars is one of the main reasons for the unusual autumn business, in the opinion of the car and truck makers. Reports from 30 trade associations throughout the country indicate that December business will be moderate, but that the market is expected to be active again with the beginning of the new year.

Motor Industry's Big Shipping Record

"Shipping of assembled automobiles from main factories and assembling plants during the past year reached the record figure of approximately 400,000 carloads, transporting 1,700,000 machines," as reported by William E. Metzger, chairman traffic committee, National Automobile Chamber of Commerce to the directors meeting of that association recently. In addition to this, over 750,000 machines were driven away by dealers from factories

Manufactured parts will amount to about 100,000 carloads and it is not unlikely that this heavy shipping will place automobiles and parts third in the number of carloads of manufactured articles shipped on the railroads. In 1921 it ranked fourth, being exceeded only by refined petroleum, iron and steel products, and cement. Much of the refined petroleum and a considerable part of cement and iron and steel shipping, however, is the direct result of motor car manufacture and use.

Eighteen thousand new box cars with extra wide door openings, known as automobile cars, have been included in railway equipment orders during the past year, which will bring the total of such cars in service up to 111,000. Notwithstanding this, automobile car supply became inadequate to handle the heavy production. Driving over the highways increased, as did the use of open freight cars. By these expedients the product was moved with fair promptness and dealers have been kept supplied.

Truck Makers to Convene

The Motor Truck committee and directors of the N. A. C. C. have called a general meeting at 10 a. m. on Thursday, Jan. 11, when important subjects can be discussed and plans definitely laid for activities that will make for a better position for the field of transporting merchandise. A cordial invitaiton has been extended to all truck makers to attend the meeting, which will be held at the headquarters of the N. A. C. C.

Papers will be read and executives in the industry will discuss some of the most pressing needs for further advancement of the truck industry. The tentative program includes among other things, discussion of the following: What is wrong with the motor truck industry? How can manufacturers and dealers cooperate to make truck paper more attractive to bankers? Is there a need for a terms committee similar to that in other industries where deferred payments are a factor in sales? Best methods for finance companies to handle truck sales, including the length of time truck paper should run.

Other subjects include: Part makers' service stations and their relation to local dealers, national users and retail customers: proper relation of the parts manufacturer with the manufacturer of motor trucks. There will be two papers discussed in the morning with two and possibly more in the afternoon.

Erskine Heads N. A. C. C. Dinner Committee

A. R. Erskine of South Bend, Ind., a director of the National Automobile Chamber of Commerce, has been made chairman of the dinner committee of that association. The annual dinner will be held at the Hotel Commodore on Jan. 9. Other members of this committee are F. C. Chandler, W. C. Durant, F. J. Haynes, R. E. Olds, M. L. Pulcher, and E. V. Rickenbacker.

List of Exhibitors at National Automobile Body Show

The following is a list of exhibitors at National Automobile Body Builders' Show, to be held at the 12th Regiment Armory, New York, Jan. 8 to 13.

American Chemical Paint Co., Philadelphia. Products and process for the removal and prevention of rust.

American Motor Truck Co., Newark, O. Motor buses.

Art Work Shop, Buffalo. Body hardware, cases and trimmings.

Blackmore Co., Charles C., Dayton, O. Door curtain opening devices.

Black & Decker Mfg. Co., Baltimore. Electric tools.

Blocksom & Co., Michigan City, Ind. Curled hair.

Boyriven, A., 225 W. 57th street, New York. Automobile fabrics.

Bridgeport Coach Lace Co., Bridgeport, Conn. Closed car upholstery, fabrics, body builders' supplies.

Brunsene Co., Watertown, Mass. Coated fabrics.

Campbell, A. S., East Boston, Mass. "Cello" curtain windows, dome lights, etc.

Carr Fastener Co., 47 W. 34th street, New York. Fasteners and lubricators.

Carter Co., George R., Connersville, Ind. Leather, artificial leather, cloth automobile trimming materials and accessories.

Cleveland Hardware Co., Cleveland. Commercial car hardware.

D'Arcy Spring Co., Kalamazoo, Mich. Auto cushions and springs, stampings and auto accessories.

Doehler Die Casting Co., Court and 9th street, Brooklyn, N. Y. Die castings.

Duncan Co., Inc., W. H., 70 Worth street, New York. Automobile fabrics and leather.

Dura Co., Toledo, O. Closed body window regulators.

Eagle-Ottawa Leather Co., Grand Haven, Mich. Automobile trimming leathers.

Eberhard Mfg. Co., Cleveland. Malleable iron and body hardware.

Edwards Co., Inc., O. M., Syracuse. Visors, anti-rattlers for sash, and sash locks.

English & Mersick Co., New Haven. Auto body hardware, windshields, radiators.

E. V. B. Mfg. Co., New Haven. Body hardware, door locks and door hinges.

Fleetwood Metal Body Co., Fleetwood, Pa. Metal passenger bodies (open and closed).

Fitz Gibbons & Crisp, Inc., Trenton. Automobile bodies.

Haskelite Mfg. Co., Chicago. Waterproof gluing.

Holbrook Co., Hudson, N. Y. Automobile bodies.

Hume Body Corp., Boston. Motor car bodies.

Laidlaw Co., Inc., 16 W. 60th street, New York. Motor car fabrics.

Larrabee-Deyo Motor Truck Co., Binghampton, N. Y. Motor buses.

Manning Abrasive Co., Troy, N. Y. Abrasive paper and cloth for auto body finishing.

Minnesota Mining & Mfg. Co., Philadelphia. Sand paper.

Mitchell Specialty Co., Philadelphia. Automobile body hardware.

Murphy Varnish Co., Newark, N. J. Varnishes, etc.

National Seal Co., Brooklyn, N. Y. Automobile door locks and window regulators.

Oxford Varnish Corp., Detroit. Varnish.

Pantasote Co., 11 Broadway, New York. Auotmobile panels and bodies.

Parsons Mfg. Co., Detroit. Automobile body hardware.

Petry Co., Inc., N. A., Philadelphia. Combination heater and tuning-up valve, etc.

Radel Leather Manufacturing Co., Newark, N. J. Leather.

Rodriguez, R. E., 56 Warren street, New York. Paints and brushes.

Russell & Erwin Mfg. Co., New Britain, Conn. Automobile hardware.

Sherwin-Williams Co., Cleveland. Undercoats, paints and varnishes.

Soss Mfg. Co., Grand avenue and Bergen street, Brooklyn, N. Y. Automobile body hardware.

Standard Textile Products Co., 320 Broadway, New York. "Meritas" leather cloth.

Textileather Co., 1819 Broadway, New York. Artificial leather.

Vacu Signal Co., Haddonfield, N. J. Automobile safety appliances.

Thompson Co., E. J., Pittsburgh. Enclosed aluminum bodies.

Valentine & Co., 456 Fourth avenue, New York. Varnishes, etc.

Waterloo Body Co., Waterloo, N. Y. Commercial bodies.

Willoughby Co., Utica, N. Y. Automobile bodies.

Zapon Leather Cloth Co., 200 Fifth avenue, New York. Zapon leather cloth and lacquer enamels.

Swedish Body-Building Industry

The Swedish body-building industry is unimportant. The entire annual output has never exceeded 150 bodies, most of which are made of wood, and while some very fine special bodies were turned out during the war, the average output does not compare favorably with American or other foreign makes in price, quality, or appearance. It is estimated that from 25 to 30 firms are building motor-vehicle bodies, usually in conjunction with wagons and other wood products. None of these concerns employ more than 30 men at the height of the season, and the average number of employees per shop ranges between 10 and 15. It is apparent that no arrangements could be made between American automotive manufacturers and Swedish body builders, with their present equipment. A list of the most important concerns in this industry may be obtained upon application to the automotive division.

Unloaded in Record Time

What is said to be a record in unloading automobiles from freight cars was set up recently when 153 Buicks, comprising a trainload of 51 freight cars was unloaded in six and one-half hours. The shipment was received in New York, where the cars were consigned, and the cars were set up in a wagon yard at night. Next morning unloading commenced, the automobiles being lifted from the cars by means of a locomotive crane and set down on the road to be driven away under their own power.

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

Fred Glover has been appointed president of the Timken-Detroit Axle Co., to succeed A. R. Demory, whose resignation from this office became effective Nov. 1. Mr. Glover became associated with the Timken organization in July, 1919, as vice president and general manager, going from Washington, where he had been chief of the Motor Transport Service, and later chief of the motors and vehicle division. The only other change made is that of chairman of the board of directors, to which position H. W. Alden has been appointed.

Myron E. Forbes has been elected president of the Pierce-Arrow Motor Car Co., Buffalo. He succeeds Col. Charles Clifton, who has for the past year filled the office of president as well as having served as chairman of the board, in which latter capacity he continues. S. O. Fellows, with the company many years and recently comptroller, succeeds Forbes as treasurer. Forbes has been treasurer since 1919. For the last year he has also been vice president and chief executive officer under the chairman of the board.

S. L. Ayr has severed his connection as assistant general manager of the central products division, General Motors Corp., and is now with the Bantam Ball Bearing Co. as manager of its Detroit territory, with offices at 905 Dime Bank building, Detroit. He was formerly for 12 years with the Packard Motor Car Co. as manager of the truck division.

Wm. E. Williams, consulting engineer, has been made chief engineer of the American Federal Wheel Co., with offices at 332 South Lasalle street, Chicago. The company, which took over the automobile wheel business of the American Steel Foundries, has its main offices in Milwaukee in connection with the Federal Pressed Steel Co.

T. E. Houghton, long in the service of the Chevrolet Motor Co., has been appointed manager of the new plant at Janesville, Wis. He succeeds H. P. Bowman, who resigned to undergo an operation and will, on recovery, engage in private enterprises it is announced. Houghton was formerly assistant manager at the Flint plant.

L. E. Blackburn, who has been connected with the Dupont company for many years on the engineering staff, has been appointed plant engineer for the Olds Motor Works, Lansing, Mich., to succeed Walter S. Kidd, who resigned recently announcing his intention of engaging in a private enterprise at Wilmington, Del.

J. F. Hartz has resigned as president of the C. M. Hall Lamp Co. of Detroit and Kenosha, an office he held for the last 12 years, and has accepted that of chairman of the board of directors. **W. F. Anklam,** secretary and general manager for the last 12 years, has been elected president and general manager.

F. W. Gargett has been apopinted assistant to the president of the Indiana Truck Corp., his duties being to look after the branches and subsidiaries of the concern. He was formerly with the Transport Truck Co., as factory manager and has been connected with the trade for a period of 10 years.

John I. Chester has been advanced from vice president to the position of president of the N. R. Allen's Sons Co., Kenosha, Wis., one of the largest tanneries of the Central Leather Co. group. He succeeds Edward C. Thiers, who resigned because of advanced age and moved to California.

David L. Gallup, well known in engineering circles, has been appointed special consulting engineer for the Beneke & Kropf Mfg. Co., on Rayfield carbureters and thermostats. Gallup for the past 10 years has been consulting engineer for Nordyke-Marmon Co.

E. A. DeWaters, chief engineer of the Buick Motor Co., has returned from a trip to Europe during which he found cause for satisfaction with foreign markets, both present and potential. American cars won most attention at the Paris and London shows, he found.

Walter Kidd, plant engineer of the Olds Motor Works has resigned to enter business for himself in Wilmington, Del. L. A. Blackburn, formerly plant engineer of the Saginaw Products Co., has been appointed to succeed Kidd.

D. S. Campbell has resigned as secretary of the Tuthill Spring Co., with which he has been identified for over 16 years. Campbell is widely known through his activities in merchandising automobile springs for replacement.

Bruce W. Ott, for many years identified with the Stoddard-Dayton and Maxwell Motor Car companies, has been appointed manager of the Fisher Ohio Body Corp., Cleveland.

L. L. Hardin has joined Anderson Motor Co., Rock Hill, S. C., as treasurer. He is a banker and business man of Columbia, S. C.

George L. McCain has joined the engineering staff of the Link-Belt Co. and will make his headquarters at the Detroit office.

R. R. Robinson has been appointed assistant manager of purchasing by the Packard Motor Car Co., Detroit.

W. G. Zahrt has resigned as vice president of the S. F. Bowser & Co., Fort Wayne, Ind.

Body Builders

Springfield Body Corp., West Springfield, Mass., a new automobile body concern, is in the process of formation. It is proposed to take over the Smith-Springfield Body Corp., and to construct a branch plant in the New York district with an annual capacity of 2,500 custom-built bodies. Negotiations are under way for still larger factories in the west, including one in the Detroit district and one in the neighborhood of Indianapolis. Altogether they plan to have an annual output of over 15,000 bodies, which, in view of the character of the trade, is something unusual in the field.

Fountain City Lumber & Body Co., Chattanooga, Tenn., recently organized, has acquired the plant of the Fountain City Mill & Lumber Co. Plans are under way for enlargements, to include the installation of a department for the manufacture of automobile bodies. The mill of Brantley Brothers has also been secured and the equipment will be removed to the Fountain City plant with additional machinery to be purchased. J. R. Brantley is president and J. V. Brantley, secretary and treasurer.

Mengel Body Co., Louisville, recently organized with capital of $1,000,000 by officials of the Mengel Box Co., Dumesnil and 11th streets, has plans in preparation for an automobile body manufacturing plant at 4th and G streets, comprising a 30-acre site, lately acquired. It will include a power house, machine shop and other mechanical departments, aggregating 200,000 sq. ft. of floor space, and will cost in excess of $500,000.

Giljack Auto Truck Body Co., Inc., Jackson Wis., has been organized with a capital of $20,000 by William H. Gilbert, Ewald G. Prahl, P. J. Hayes.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Studebaker Corp., South Bend, Ind., plans further expansion of its facilities. An addition to the closed-car body plant will be 172 x 518 ft. and four stories. An extension to the power house, 48 x 115 ft., two stories, is now being erected. Improved arrangements for the final inspection and testing of cars will be provided by a one-story glass-covered building, 40 x 624 ft., which will connect the shipping and storage department with the final assembly department. There will also be a new four-story car shortage building, 76 x 624 ft., and a train shed, 80 x 624 ft. These buildings are part of a general expansion program which includes also two additions to the Studebaker plants at Detroit. One of these units will be a five-story building, 58 x 441 ft., to house final assembling and testing departments and the other a structure, 95 x 248 ft., for various machining operations and stores. All of the buildings will be of reinforced concrete.

Crane-Simplex Co., Inc., 115 Broadway, New York, recently organized, has acquired the property and equipment of the Simplex Automobile Co., New Brunswick, N. J., from the Mercer Motors, Inc., Trenton, and will resume the manufacture of the Simplex car in a plant at Long Island City, where a building will be equipped and placed in operation early in January. The New Brunswick plant was used for the manufacture of Hispano-Suiza airplane motors during the war, when production of the Simplex automobile was discontinued, and will not be utilized by the new organization at the present time. L. R. Ayers is president of the new company; John B. Bawden, jr., for the past 10 years associated with the Mercer organization, is vice president and general manager; Harvey B. Clark and Frederick H. Brand, identified with the former Simplex company, are treasurer and assistant treasurer, respectively.

New Process Gear Co. of Delaware, Syracuse, N. Y., has been organized by T. W. Warner, of the T. W. Warner Corp., Toledo, O., and W. C. Durant, head of the Durant Motors, Inc., New York, with capital of 300,000 shares of stock, no par value, to operate the local plant of the new Process Gear Corp., recently acquired. Plans are being prepared for enlargements for the manufacture of gears and transmissions for the Durant and Star cars. T. W. Warner heads the new company; C. R. Burt is manager.

Yoder Co. plant at Cleveland was partially destroyed by fire a few days ago. The building containing the manufacturing departments equipped with about 40 machine tools was burned and it is expected that only about 25 to 40 percent of these can be salvaged. The company is rebuilding this portion of its plant and expects to be operating again in a few days. It will be in the market shortly for machinery to replace the tools lost in the fire.

Ford Motor Co. of Canada, Ltd., Ford, Ont., has awarded the general contract for a machine shop to cost $1,500,000. Contracts for machinery and tools have not yet been placed. The company, however, recently placed contracts for direct current motors. It is the intention of the company to do away with belt drives and has adopted direct motor drive for its entire plant.

Daniels Motor Co., Reading, Pa., is arranging for additional manufacture at its plant, and will construct engines for its cars in entirety in the future, eliminating outside parts production and local assembling as heretofore. New machinery has been installed in a number of departments and further expansion is planned. George E. Daniels is president.

Standard Equipment Co., Lorain avenue and W. 106th street, Cleveland, plans the erection of a new factory for the manufacture of automobile axles, which the company plans to make in addition to its present line of differentials and gears. It will provide a capacity for 250 to 300 axles per day. O. J. Ashman is vice president and general manager.

Studebaker Corp., South Bend, Ind., has arranged for the establishment of a factory branch and service works at 832-34 N. Meridian street, Indianapolis, occupying the building formerly used by the Sterling Motor Car Co. W. J. Owens will be in charge.

Mason Motor Truck Co., Flint, Mich., a subsidiary of the Durant Motors, Inc., 1819 Broadway, New York, will operate an eastern assembling plant in a portion of the factory of the Locomobile Co., Bridgeport, Conn., another interest of the Durant organization.

Rickenbacker Motor Co., Detroit, has acquired the former plant of the Detroit Steel Co., and will remodel the structure for early occupancy. It will provide a total floor area close to 500,000 sq. ft. A one-story addition will also be erected to cost $12,000.

Ford Motor Co., Highland Park, Mich., has preliminary plans for a three-story assembling plant at Cambridge, Mass., estimated to cost $250,000. It is proposed to acquire an existing building and remodel it.

Ford Motor Co., Highland Park, Mich., has tentative plans for a new assembling plant, 300 x 1500 ft., in the vicinity of St. Louis, estimated to cost $2,000,000 with machinery.

Ford Motor Co., Detroit, has filed application for permission to construct a hydroelectric power plant in the vicinity of St. Paul, Minn., estimated to cost $750,000.

Additional Notes of Body Builders

Trailmobile Co., Cincinnati, has awarded contract for a new plant and warehouse adjacent to its present property in the Oakley district. The present plant has been sold to the Fay & Egan Co. Work has commenced and it is expected that the Trailmobile Co. will occupy the plant on Feb. 1. Little new equipment will be required. Murray Shipley is president.

Cutten & Foster, 302 Church street, Toronto, makers of auto tops, etc., will build an addition to cost about $50,000.

Coupe De Luxe Body Co., St. Louis, has leased 15,000 sq. ft. at 13th and Rutger streets, in the vicinity of its present automobile body manufacturing plant, and will use it for expansion.

Edward G. Budd Mfg. Co., 25th street and Hunting Park avenue, Philadelphia, manufacturer of steel automobile bodies, has taken title to a five-story concrete factory at the northeast corner of 25th and Stokley streets, heretofore held by the Simmons Co., for $425,000. It will be used for extensions.

Martin-Parry Corp., York, Pa., manufacturer of commercial automobile bodies, has plans nearing completion for new works at Monument and Fallsway streets, Baltimore, totaling about 12,000 sq. ft. of floor space, to be equipped for assembling.

Wiener Body Co., 252 Academy street, Newark, manufacturer of automobile bodies, has acquired four acres on Hoffman Place, Irvington, for the erection of a new plant. Max Wiener heads the company.

Chicago (Ill.) Avenue Commercial Auto Body and Wagon Works, Inc., has been organized to manufacture and deal in motor vehicle bodies, wagons, etc. Capital $7,500.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

4240—Motor cars, motor trucks, motor cycles and tires and accessories in the automotive line—Germany. Purchase and agency desired. Quotations c.i.f. German port.

4267—Automobiles selling for $450 to $2,500, light tractors, motor cycles, bicycles, automobile bodies, wind shields, rubber pads, telephone tubes, horns, lamps, patent fasteners, top covers, ball bearings, and vulcanizing outfits and supplies—Hungary. Agency desired. Quotations, c.i.f. Hungary.

4278—Batteries and magnetos for motor cars, lighting. etc.—South Africa. Purchase and agency desired. Quotations, f.o.b. New York. Payment to be made in New York.

4297—Specialties in automobile accessories, particularly those sold by the hardware trade—Cuba. Purchase desired. Quotations, f.o.b. New York.

4318—Automobile and motor cycle accessories and novelties—Victoria, Australia. Purchase and agency desired. Payment, cash in New York.

4320—Motor busses—Sweden. Agency desired and also the purchase of all kinds of motor supplies.

4321—Automobiles, motor cycles, accessories, benzine, tires, vulcanizing and retreading outfits, air compressors, etc.—Hungary. Purchase and agency desired. Quotations, c.i.f. Hungarian port. Correspondence, German, French or Hungarian.

4350—Agricultural machines, tractors, automobiles (lighter and cheaper cars), motor trucks (1½ to 3 tons), and motors of various descriptions—Baltic Provinces. Purchase and agency desired. Quotations, c.i.f. Baltic port. Correspondence, German.

4352—Motor cars, motor cycles, and accessories, spares, and tools of every description—India. Purchase and agency desired. Quotations, f.o.b. New York.

4365—Rubber tires, electric light bulbs, and all accessories for low-priced automobiles, and lubricating oil—Chile. Purchase desired. Quotations, c.i.f. Chilean port. Terms: Cash against documents. Correspondence, Spanish.

4419—Automobile and accessories, bicycles and accessories, and parts for same—Sweden. Purchase desired.

4502—Automobile accessories of all kinds, especially tires and inner tubes—Tunisia. Agency desired. Quotations, c.i.f. Tunis. Correspondence, French or Italian.

4543—Light 6 or 7 passenger automobiles, and automobile accessories and specialties, tires, air pumps, gasoline tanks, and vulcanizing outfit—Hungary. Agency desired. Quotations, c.i.f. Hamburg.

4547—Bicycles and parts, accessories, tires, and tubes of standard grades—Hungary. Purchase desired. Quotations, c.i.f. Hamburg. Terms: Cash against documents in New York. Correspondence, German or Hungarian.

4565—Motor cars, motor cycles, electric fittings, automobile parts and accessories, carbide manufacturing plant, petrol filling pumps with tanks, perambulators, side cars, and spare parts, such as axles and wheels, and upholstering materials for cars—India. Purchase and agency desired. Quotations, f.o.b. place of manufacture.

4568—Six to seven passenger cars and accessories, tires, and vulcanizing and retreading outfit specialties—Hungary. Agency desired. Quotations, c.i.f. Hamburg. Correspondence, French, German, or Hungarian.

4575—Automobile brake linings, and spark plugs—Norway. Agency from manufacturers desired.

4585—Automobile tires—England. Agency or purchase desired. Quotations, f.o.b. port of shipment. Payment, cash.

4600—Automobiles, motor cycles, etc.—Sweden. Purchase desired. Quotations, c.i.f. Malmo or Goteborg. Terms: Cash against documents.

4606—Automobiles, motor trucks, motor cycles, and tires —Germany. Agency desired. Quotations, c.i.f. German port.

4613—Automobile accessories, car ornaments, wind-shield cleaners, spot lamps, etc.—Spain. Purchase and agency desired. Correspondence, Spanish or French.

4619—Automobile accessories, and miscellaneous merchandise—Canada. Agency desired. Quotations, f.o.b. Canadian port.

4642—Automobile tires—Poland. Agency desired. Quotations, c.i.f. Danzig. Payment, in United States currency.

4673—Rubber tires of the clincher type—Egypt. Purchase and agency desired. Quotations, c.i.f. Alexandria. Terms: Cash against documents.

4677—Steam-propelled automobiles—Australia. Agency and purchase desired. Quotations, f.o.b. American port.

4682—Automobile specialties, accessories, and supplies—Czechoslovakia. Purchase desired. Quotations, c.i.f. French or Holland ports. Correspondence, Czech, French, or German.

4683—Modern motor appliances for fire department—South Africa. Purchase is desired from manufacturers of fire-fighting apparatus.

4685—Automobile parts and accessories, also hardware and construction material—Mexico. Purchase and agency desired.

4689—Automobile tires of first-class manufacture—Austria. Agency desired. Quotations, f.o.b. New York.

4691—Asbestos brake linings, asbestos friction clutch facings, metal and asbestos gaskets, including cylinder-head packings, and radiator cement—Norway. Purchase and agency desired.

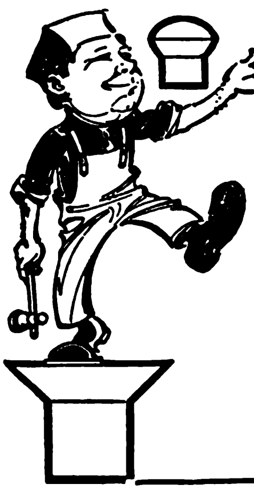
4694—Speedometers for automobiles, motor cycles, and bicycles, measuring in kilometers; meters for gas, water, and electricity; clocks and accessories; and automobile accessories, including tires, pistons, and carburetors—Belgium. Agency and consignments desired. Quotations, c.i.f. Antwerp.

4712—Four-cylinder motor cycles—Austria. Agency desired. Quotations, f.o.b. New York.

4714—Automobiles, motor cycles, motors, etc.—Sweden. Agency desired. Quotations, c.i.f. Goteborg.

4743—Automobile accessories such as lighting systems, electric starters, and furnishings for automobile bodies —Austria. Agency desired. Quotations, f.o.b. New York.

The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1, Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3, Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.



MADE TO ORDER

and Delivered on Time

RIVETS Made to order only. .035 to .375 diameter
ESCUTCHEON PINS Carried in stock in Brass and Iron
Made to order in other metals
Send sample or rough sketch for estimate and state quantity wanted. Quantity makes the price

JOHN HASSALL, Inc. Clay and Oakland Sts., Brooklyn New York Established 1850

The Best Bearing Metal on the Market

FAHRIG ANTI FRICTION METAL

A Clean, Homogeneous Tin-Copper Alloy Made by Our Special Formula From New Raw Material for Use as a Babbitt

FAHRIG METAL CO., New York

WILCOX

FINE FINISHED FORGED

CARRIAGE HARDWARE AND GEAR IRONS

Write for Prices and Catalog

The D. Wilcox Mfg. Co.
MECHANICSBURG, PA.

ECONOMIST-ENGINEER
Constructive Policies—Ways and Means—Diagnosis
Production—Managements—Sales—Exports

W. J. SPENCER M. E., E. E., L. L. D.
Manufacturer & Builders' Exchange
410-416 Bond Building WASHINGTON, D. C.
Pittsburgh — Cleveland — Chicago — Dallas

Tycos temperature instruments

Assure maximum quality by minimizing mistakes where temperature is a factor in your industry. Proved by results where *Tycos* instruments are installed.

Taylor Instrument Companies
Rochester, N.Y. U.S.A.
There's a *Tycos* and *Taylor* temperature instrument for every purpose

---

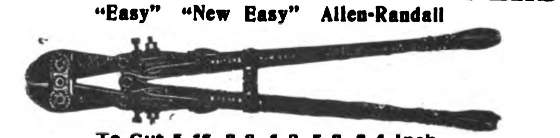
SUBSCRIBE TO
The AUTOMOTIVE MANUFACTURER
the Best, and at the same time, the Cheapest Journal covering the Automotive Field
Only $2.00 a Year Subscribe Today

Electrical Testing Laboratories

80TH ST. AND EAST END AVE., NEW YORK
Electrical Photometrical and Physical Test
TESTS OF
Head Lamps, Chemical and Metallographic Examinations of Steel and Iron, Lubricating Oils, Gasoline, etc.

PORTER'S BOLT CLIPPERS

"Easy" "New Easy" Allen-Randall



To Cut 5-16, 3-8, 1-2, 5-8, 3-4 Inch.
H. K. PORTER, EVERETT, MASS.

KRAKNO

Is the greatest filler or surfacer known to the Auto Painter. You can't afford to operate your Paint shop without it. Price $3.50 per gal. Send for descriptive circular.

The R. F. Johnston Paint Co.
Cincinnati, Ohio

Why Not Have the Best?

One of a Large Variety
C. Cowles & Co.
NEW HAVEN, CONN.

THE CHARLES WING CO.
Established 1848
Manufacturers and Wholesale Dealers in
AUTOMOBILE AND CARRIAGE HARDWARE AND TRIMMINGS
AMESBURY, MASS., U. S. A.

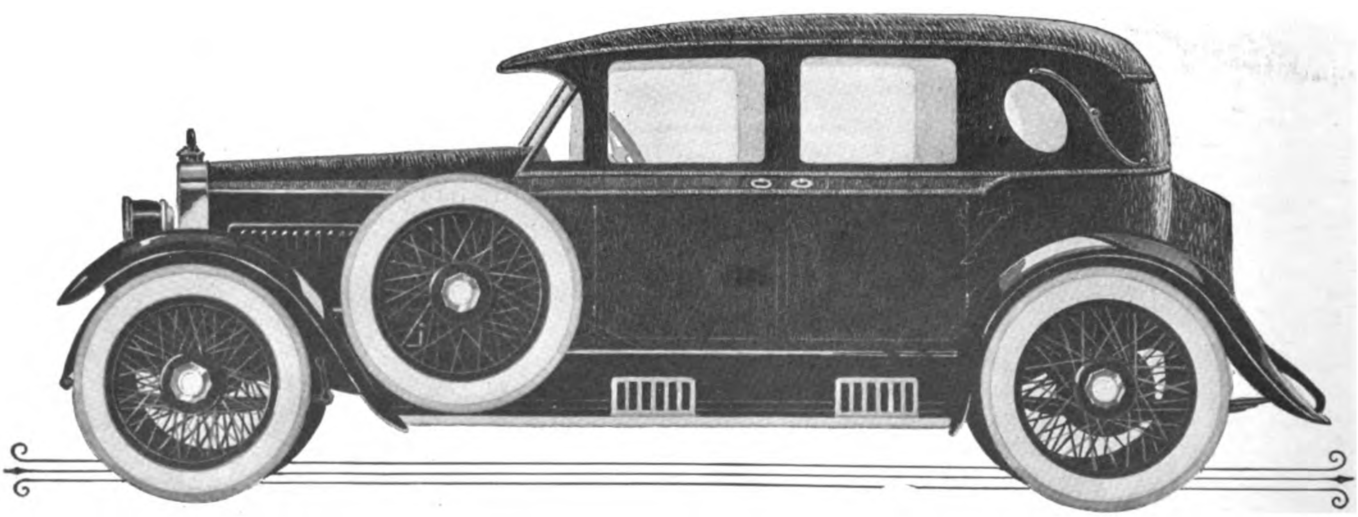
The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. LXIV. No. 10 | JANUARY, 1923 | $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3.



The Automotive Manufacturer

A Consolidation of The Hub and Automotive Engineering

Vol. LXIV. NEW YORK, JANUARY, 1923 No. 10

Handling Material in Automotive Plant--II

System at Studebaker Plant—Tractors Effect Large Savings — Machine Shop Layout and Handling of Scrap Are Features

Continued from Page 28, December Issue

AFTER delivery of material to rough stores from the forge shop, stamping division, receiving room, etc., the truck is placed in a designated spot. The design of the truck permits lifting by crane and piling one on the other. Small cranes are installed in each bay in the rough stores for lifting the truck to the proper pile, and for lifting down and conevying to the nearest aisle for making up of trainloads to go to the machine shop. Some 800 to 1000 of these box trucks are employed, filled with material in rough stores. Certain large pieces are, of course, handled by hand and piled on receipt from the receiving department.

The question has been raised of carrying these trucks in stores, equipped with wheels, axles, clevises, and front legs. It has been found that the hardware involved will not begin to offset the additional expense required for hoists, the higher cost of the chassis, etc.

Tractor Operation Means Large Savings

Tractor operation has accomplished a tremendous saving in non-productive labor and has also worked in admirably with the system of maintaining small banks of material in each department operating, for the reason it works on a scheduled basis entirely, and tends to keep the flow of material constant. The trains of material are made up entirely in the different clearing stations and rough stores. The trucks are lifted from their piles in rough stores, for instance, and placed in proper order in the making-up aisle, ticketed for transfer, third wheels are inserted, and trucks coupled together by the rough-stores men. The operation is on the principle of a railroad.

The equipment is all numbered. In comes the tractor with the driver alone. The driver carries a supply of third

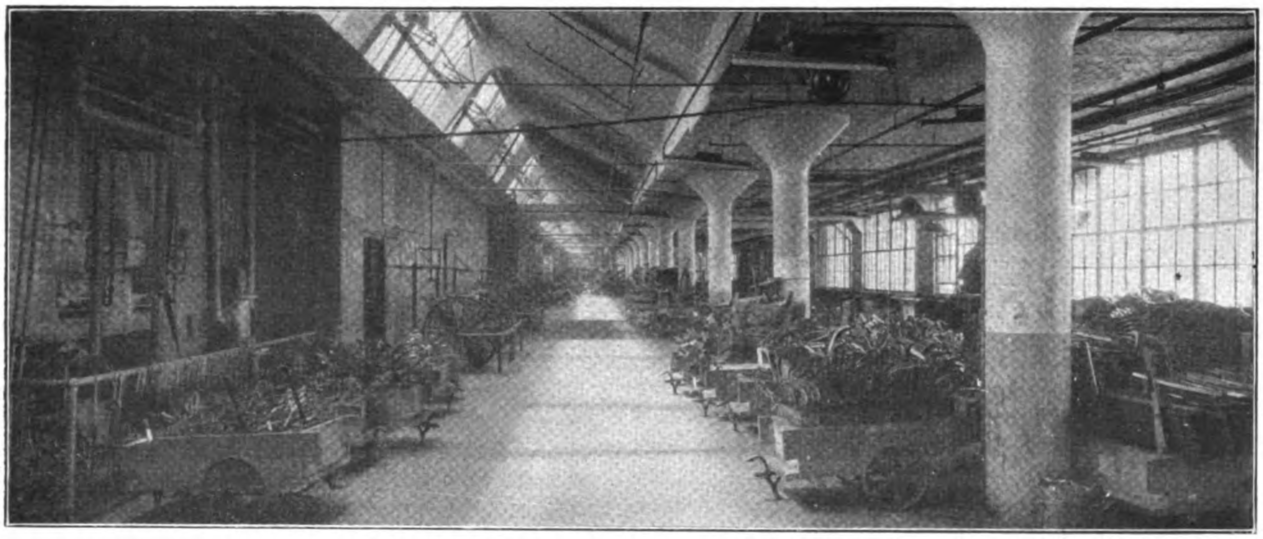


Fig. 4—When the train reaches a station, loaded trailers are detached and those ready for hauling are coupled to the train, the tractor operating acting as the train crew. If a given trailer is detained beyond allowed time, its contents are dumped on the floor and it is put into the train for active service.

Reproduced by special editorial arrangement, from Iron Age, New York.

wheels in a box on top the battery compartment, and drops the same number as are picked up on trucks. He immediately hitches up to the train after dropping from his load such trucks as are consigned to rough stores. He then proceeds on his route, which is exactly laid out, his time of arrival and deparature from each stopping point being carefully planned. He rings a time card at each stopping point on a time clock, which, by its print, shows where he was. These cards are turned in to the dispatcher's office at night so delays may be noted. These delays seldom occur, as it is a matter of pride on the part of the driver to be "on time." The men in the stores and clearing houses also expect him on time, and it is to their interest to have the train ready for him to prevent delays, as his instructions are to report by telephone to the dispatcher whenever he is held up. The schedules are arranged so the tractor is kept moving all the time.

The train now proceeds to the machine shop. Material is delivered daily to the machine shop in sets with the exception of small pieces, a large supply of which can be placed in one truck.

Only Two Truckers in Machine Shop

The machine shop is a 500 x 520 ft. building of one-story, saw-toothed construction. An inspection bay walled and screened in, 49 ft. wide, runs through the exact center. All raw material is delivered to the proper one of the two aisles. The tractor is not allowed to get out of this end aisle. The trucks are cut out in the end aisle at the end of the row of machines in which the parts are manufactured. Two hand truckers are provided, one on each side of the inspection bay. Their duty is to assist the driver in cutting out trucks at proper points and pulling work to the first operation. These two men also pull back empty trucks and assist in coupling to the next train that comes through. The work is handled automatically from the first operation to the inspection bay. No trucks containing material are allowed past the first operation.

Many automatic devices are used. Overhead chain conveyors, from which baskets of work can be suspended, are utilized to advantage. Other conveyors with hooks on which the piece can hang are used. Belt conveyors of all types are found on many of which deflectors have been placed, so that when one man is performing operation one and three men are on operation two, the work is deflected automatically to the proper man on operation two. Cast iron tables with high sides are provided for many of the operators, in which the work is placed from the preceding operation by hand, when the machines are close, or in many cases by an inclined steel chute, and in others by gravity conveyors. It is insisted that very small amounts of material in process be carried. This has been accomplished mainly by the automatic equipment which allows and in reality forces rapid dispatch from one operator to another.

Upon receipt of finished material in the inspection bay it is placed, if OK'd, in the proper receptable and arranged in proper place in the train being made up. The tractors, after delivering rough stock, proceed with empty trucks to the inspection bay and, by dropping the empty trucks, pick up the train ready. It now goes to the two crane bays in the assembly building previously described, where the proper trucks are cut out and handled to the balconies by crane.

Many special boxes and racks in conjunction with trucks are used in carrying finished material from the machine shop to the finished stock. They are all capable of being included anywhere in the train, however. Gears and ground work are carried in special boxes which are inserted and fit into the regulation box truck.

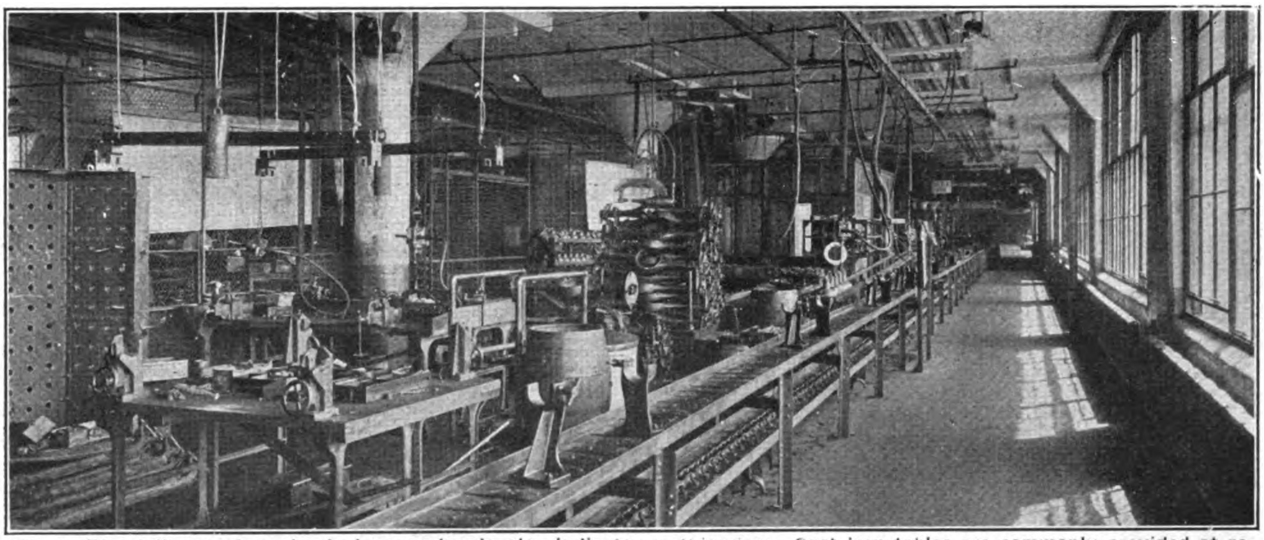


Fig. 5—The full use of mechanical conveying is also indicated in this view. Cast-iron tables are commonly provided at receiving stations, and the system as a whole serves to keep down the amount of material in process of manufacture.

System Prevents Lack of Empty Trucks

For a time, there was a severe want of empty trucks. Numbering them helped a good deal. Also, the tractor drivers are all provided with printed tag, which they hang on any loaded truck standing anywhere for 48 hr. This is a notification to the foreman of the department where the truck is located that he must get this truck moving within 24 hr., or the truck will be dumped and put in service, and the foreman must then get along as best he can. The banks are maintained so no material in process can be held for more than 72 hr. without operations being performed. The transportation department has absolute authority over all trucks, no matter where they are.

After leaving the assembly buildings, the train proceeds to the stamping division, then to the carbonizing department and forge shop, and then through to the rough stores when the operation starts once more. This route is one mile long, and is covered in 30 minutes.

A charging department equipped with sufficient stands

to handle all tractors at one time is maintained adjacent to the dispatcher's office. The tractors are, of course, all put on the charging stand at the noon hour. No trouble is experienced because of lack of power if the tractor is charged at noon.

Loads are heavy and the tractor is pulling a load practically all the time. Repairing of the tractors is done at night. No spare tractors are maintained. The repair expense was not watched carefully until recently. Without any check, this item amounted to $1 per tractor per day. It now amounts to 75c per day per tractor, and will drop to 50c per day per tractor, or less.

Other Tractors Used for Handling Other Material

In addition to the three tractors described and the one on unit assemblies, five others are used.

One is for handling enamel, oils and greases, and another for handling dies to and from stamping and forging divisions to die room, and also carrying completed work from press room to inspection bay.

A third is for handling scrap, another for pulling large wagon trailers into buildings after same have been dropped outside by our gas tractors. Also handling hoods to the final car shipping department, and the fifth is on miscellaneous work of all kinds. All except the last run on schedules with no variation in the kind of work they handle outside the layout.

Equipment used with tractors must be designed to track as perfectly as possible. A train of 50 box trucks will pass through a 6½-ft. door at a right angle turn. In fact, every trainload of material from the machine shop must pass through a door of this size at right angles. The design of the box trucks calls for 18-in. semi-steel wheels of Studebaker manufacture, with 3-in. face at each end of a 1⅛-in steel axle, cold rolled. Steel rollers are used for roller bearings. For 4-wheeled trailers, a 3 x 6 ft. truck is used equipped with a spring rigging, which runs the entire length of the trailer, and takes the strain of starting and stopping and pulling the load from the framework. The platform is 14 in. high on all trailers so they will pull in a train with box trucks. With a few exceptions the equipment on trucks is standard, holding to the three sizes on box trucks and the one type on four-wheeled trailers.

A complete repair department for box trucks and trailer trucks is maintained. Trucks are inspected and oiled by one man who travels continually. As he finds a truck needing repair, it is tagged with a large tag reading "repair," and pulled to the nearest tractor route, where it is picked up by the tractor. A system of putting a small spot of paint on the rear end of the truck is used as it is oiled. All trucks are oiled once a month, red for October, blue for November, white for December, etc. This enables us to check this important item at a glance.

A phase of material handling that has still been overlooked by many industries is the matter of waste material. The original installation cost money but has paid for itself the company believes, many times. For instance: directly under the inspection bay and running the full distance of 500 ft. across the machine shop building, the same width as the inspection bay above, is a so-called scrap tunnel. All turnings, borings, etc., are deposited on conveyors leading directly down into 3x6 ft. steel tanks on four-wheeled trucks in the tunnel.

One tractor is used by the scrap department, in pulling these trucks out, and also gathering scrap from certain departments in other buildings. Loads are pulled up a 10 percent grade from this tunnel outside the building, and from there taken to the scrap department located at one end of the plant in the forge shop building. Again the overhead cranes serve to lift the steel tanks off the truck itself, dumping the material into the bins located at each side of a depressed track and above it. These bins are equipped with steel chutes extending out over the gondola cars on the track.

The sheet metal trimmings are thrown on a 48-in. wide belt which runs the full length of the press room by the side of one row of presses, by the operator where possible, and where this is not possible, the scrap is accumulated in steel tanks on 3 x 6 ft. trucks and dumped on the belt by cated at one end of the building where it is baled. The bales are handled by magnet from the pit to gondola cars.

In handling flashings, etc., in the forge shop, hand labor

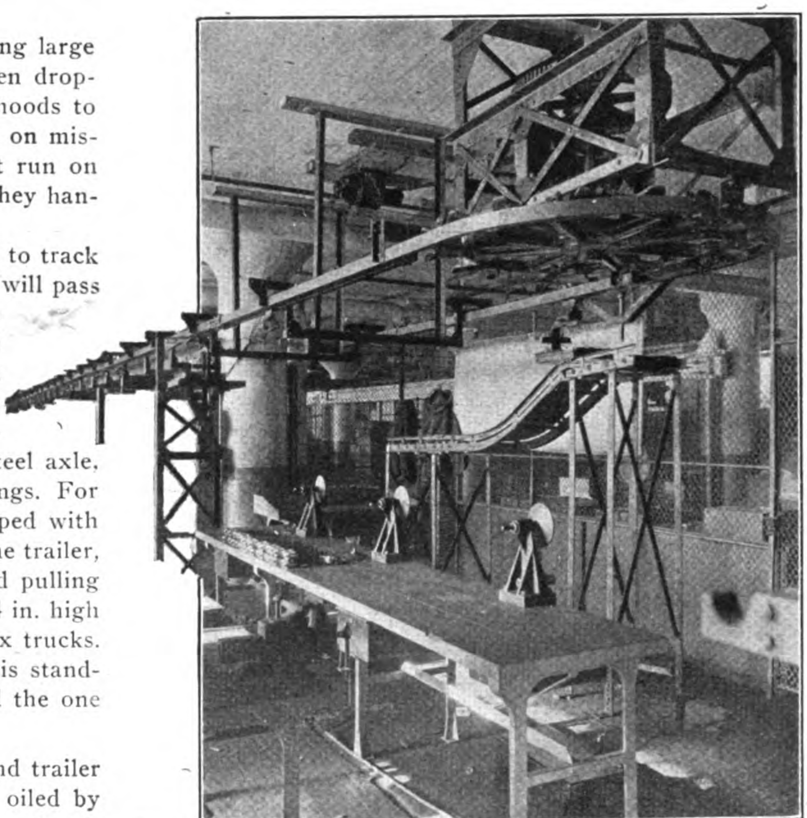


Fig. 6. Overhead chain conveyors provide for delivering baskets for work from place to place.

plays practically no part at all. Paper is baled on the receiving docks. Also gondola cars are spotted on depressed tracks wherein all scrap wood is broken up and piled and rubbish is accumulated. These items are separated as they are placed in car. At night cars are pulled out to the scrap department and replaced by empty cars. An incinerator for disposal of rubbish is operated by the scrap department, and the car is thus spotted next to the incinerator. Rubbish is unloaded from one side for burning and wood is unloaded on the other into wagons for sale to employees. Sweepings and rubbish from floors above the ground floor are carried to the end of the buildings and thrown down a steel chute, leading down into a high sided wagon placed under the chute on a drive through the building. Once a day these wagons are replaced by empties, and the load is pulled to the incinerator by a gasoline tractor.

Recent Novelties in Engine Construction--II

Improved Forms of Cylinder Construction and Arrangement—New Valve Forms—Rotary Valve With Adjustment for Constant Clearance—Single Sleeve Valve Engine.

Continued from Page 24, December Issue

ONE of the newer engines to appear in England is the Sproule. It is claimed generally that the drawbacks of the ordinary engine are: limited flexibility, absence of overload capacity, low efficiency at light loads and difficulty of reversing, if indeed the latter is even possible. That is, the internal combustion engine can show its best results only at full or approximately full speed.

In the design of this engine a pair of pistons work in a common combustion space, each piston operating a separate crankshaft. The two shafts are geared together at a 2 to 1 ratio, so that one piston makes two complete strokes while the other makes four. The method of gearing the two cranks is such that the relative angular setting of the two crankshafts in respect to each other can be varied at will, whether the engine is in motion or not.

When the two cranks are set so that at a given time in the cycle the two pistons are together at the back end of their strokes, the minimum compression space is available. In this case a small charge of gas will be compressed normally, but will be expanded to more than its original volume, giving an increased efficiency. If, now, the two-stroke crank is advanced relatively to the four-stroke crank, the two pistons cannot coincide at the back position, so that the minimum compression space becomes the fixed space plus a small portion of the two-stroke cylinder volume, the total giving the larger space necessary for a heavier load. The expansion ratio will now be less, but up to the normal full load it is still greater than the compression ratio and gives a high expansion efficiency at loads up to full load. The two-stroke crank can be advanced to give about 40 percent more than the normal full-load charge, the expansion ratio being then a little lower than the compression ratio, so that a large overload capacity is provided with only a slight drop in efficiency.

It is claimed that this engine, while retaining all the advantages of the ordinary internal-combustion engine, is as flexible as the steam engine.

One of the prominent exhibits at the recent big show at Grand Central Palace, New York, was the improved Bournonville six-cylinder engine. This is a rotary valve unit but the principal change which has been made in it is the self-adjusting device which adjusts the clearance between the rotary valve and the cylinder head. This refinement, which is set forth as a final touch to the development of the Bournonville mechanism, consists of so mounting the overhead rotary valve shaft that it shall be held against the cylinder block under a pressure that is both constant and yielding.

The adjustment is accomplished by mounting a shoe over the upper side of the shaft, and by wedging this shoe in position with a wedge that is backed up by a spring. Under conditions of wear this spring simply forces the wedge closer. Under conditions of possible overheating the wedge is forced back slightly against the spring, thus avoiding any tendency to stick.

Essentially the system is exactly the same as when it was first disclosed. On top of the cylinder block, with its single port per cylinder, the Bournonville shaft is laid. This shaft is hollow, and is provided along its length with circumferential recesses which may serve either as inlet or exhaust passages, according as they connect the cylinder port with the fresh gas supply or with the exhaust manifold.

Directly above this shaft the regulating shoe is laid, and the latter is covered with the cylinder cap. The space between the top of the shoe and the engine cup is tapered, and it is into this that the wedge is fitted. This wedge is held firmly in place by a spring which itself is supported against the engine cap. In event of any measurable amount of wear on the valve shaft, or its seat, the wedge is permitted to be forced further in to the taper, which also forces it lower against the valve shoe. In event of expansion due to excess heat at the valve shaft this very expansion causes the shoe to be lifted, the spring pressure against the wedge controlling this lift as to its size.

With this improvement in its valve mechanism the Bournonville company also has developed its own hot spot system for fuel. This was an individual problem since the rotary valve engine uses only an exhaust manifold, its intake gases being handled through the rotary shaft. The

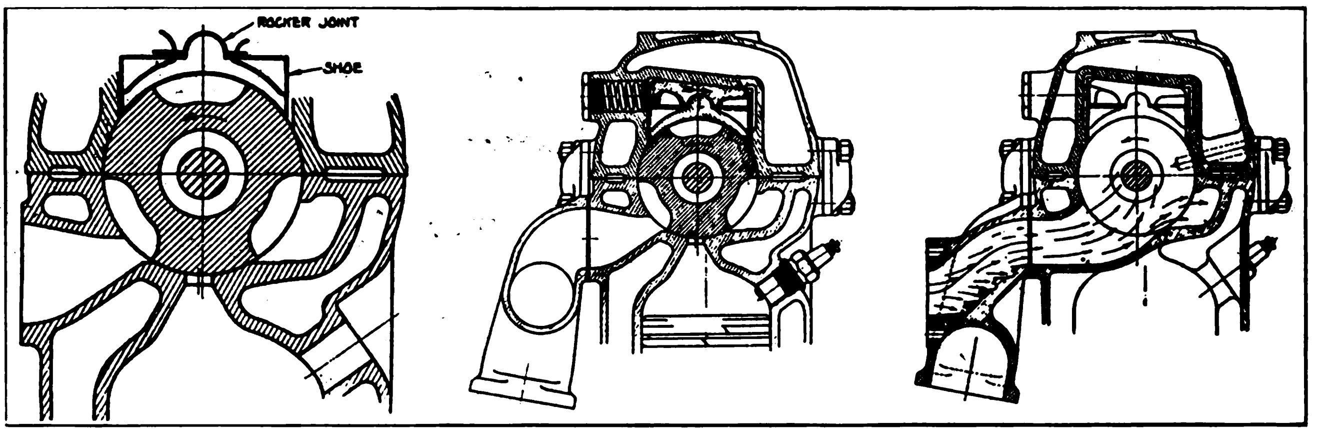
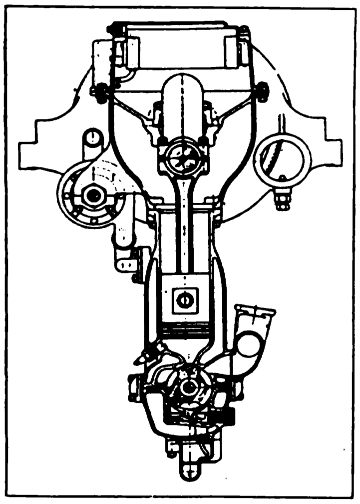


Fig. 6. Details of the new Bournonville rotary-valve engine. At left, adjusting shoe for rotary valve. Center, the assembly complete showing spring. At right, intake manifold with hot-spot arrangement.

carbureter is mounted directly on the exhaust manifold, and feeds its gas into a passage where the gas is led over a series of steps which are heated from the exhaust directly into the block head. At this point a portion of the gas passes into the interior of the shaft, where it is carried both forward and rearward and emitted at the end of the shaft back into the gas passage in the head.

A portion passes directly from the carbureter passage into the head and this, together with that which comes from the ends of the shaft serves to produce a uniform volume of gas all through the passage.

Another new valve, or rather old one in modified form, is the former Argyll (Scotch) cuff valve or single sleeve, which was later known as the Burt and McCollum, and now is called the Wallace. It has undergone many important changes, but despite these has been used continuously in the Agryll car since 1911, and since the year before the war on the Piccard-Pictet (Swiss) car. In its most recent form as shown in section in Fig. 6 it is being built for heavy duty service, for trucks, tractors, motorcycles, house lighting outfits, portable power plants, etc.



Section 7. Section through the Bournonville rotary valve four-cylinder engine.

The London General Omnibus Co. secured such good results from the first heavy duty type submitted to it for trial that it had had a dozen special heavy bus type engines of this form built. The detailed modifications are not available, and the tests are still in process.

The essential difference in design between this single sleeve valve engine and the conventional poppet valve type lies in the valve and the valve actuating mechanism; the parts are not necessarily different.

The sleeve valve has port openings cut on its circumference to correspond with ports cut in the circumference of the cylinder bore. By means of a suitable driving mechanism, a partly reciprocating and partly rotating motion is imparted to the sleeve valve so that joints on it travel in a more or less elliptical path.

With the four-stroke cycle engine the sleeve valve is driven at half engine speed and the ports thereon are arranged so that during the first portion of the upward valve stroke the inlet ports uncover the corresponding ports in the cylinder wall. During the compression and power strokes the sleeve valve is at the top portion of its travel and the port end is covered by the water-jacketed cylinder head. On the last portion of the downward stroke of the valve the exhaust ports in the cylinder are uncovered and the cycle is completed.

In the cycle of movement when the sleeve valve is subjected to the maximum pressure—that is, during the compression and power strokes—it is traveling in the same direction as the piston. During operation the valve never comes to rest, and at no time is there a sudden reversal in direction of travel.

The peculiar twisting motion of the valve has inherent advantages. The natural spreading of lubricant is said to reduce oil shear between the valve and the cylinder, and also between the piston and the valve, the latter, it may be noted, being devoid of oil grooves or scrapers. The motion, it is claimed, also helps in the transference of the heat lost to the cylinder walls and to some extent in baffling the gases against leakage. Junk rings are not fitted to the cylinder head as in most other sleeve-valve designs.

Large Water Spaces Provided

The cuts show the large water spaces which can be had at all points in this type of engine. Water passages are cast between the exhaust port cores to convey the cooling water from the bottom of cylinder to the top and at the same time to present a water-cooled surface to the edges of the valve exhaust ports as they pass between the cylinder ports. The exhaust ports are therefore in contact with water-cooled surfaces for three-fourths of the valve cycle. The top end of the cylinder is closed by the detachable head, which, being of the same diameter as the piston, and projecting into the cylinder, forms an annular space in which the upper end of the valve works.

Many different drives have been designed to actuate the valve. Type 1 is the original drive as fitted to the early Argyll engines; it gives good service but is somewhat heavy and expensive to manufacture. A valveshaft geared to the crankshaft has a small worm wheel opposite each engine cylinder; this wheel engages with a disk wheel which revolves at half-engine speed.

On the face of the disk wheel, parallel to and at a fixed distance from its axis, a hole which may be called the sleeve crank is located and in this hole an actuating pin is free to slide. The head of the pin is flattened and fits between the lugs at the bottom of the valve. It is held in position by a pivot pin which passes through corresponding holes in the actuating pin and sleeve-valve lugs. The actuating pin works in and out of the sleeve crank hole and sideways between the sleeve-valve lugs.

As the sleeve crank revolves with the actuating pin, it carries the sleeve valve with it, so that the valve itself, besides traveling up and down also travels sideways on either side of the cylinder axis.

Type 2, known as the link drive, obviates the use of gear wheels. A valveshaft or small thrown crankshaft is driven at half engine speed from the engine crankshaft Opposite each sylinder is a crank pin and mounted on this is the actuating link. One end of the link has a bushed boss which is free to slide axially on the crankpin, while the opposite end is flattened and engages between two lugs cast integral with the sleeve. A pivot pin fitted through the lugs secures the link thereto but allows relative movement between the two in a horizontal direction.

In type 3 a ball-and-socket coupling, which obviates the accurate fitting of other drives, is employed. A half-speed crankpin driven from a gear shaft is inserted into the bore of sphere, which in turn is located in a fixed spherical housing at the lower end of the valve. As the crankpin revolves the valve is carried up and down as well as sideways. The ball coupling has a small reciprocative movement along the crankpin. It will be seen that this drive occupies less space and is lighter in weight than the others. It also gives a larger port opening for a given valveshaft stroke.

Type 4 is the drive used for many years on the Piccard-

Pictet cars. It is simply type 1 elaborated to give better qualities.

Alternative Cylinder and Port Designs

There are certain alternative cylinder and port designs, and one of the former is shown in Fig. 8a. Here, it will be seen, a separate liner is inserted in the upper end of the cylinder bore, the ports being cut in this liner while passages are formed in the cylinder block in such a way as to permit of placing inlet and exhaust manifolds on the same side. The latter feature can, however, be provided in any event, hence the separate liner is recommended as a rule only when a multiplicity of the small size ports makes direct cutting in the cylinder wall a somewhat difficult operation. A separate liner is used on experimental engines to enable various port settings to be tried with minimum outlay.

The number and arrangement of the ports in both cylinder and sleeve can be varied. In one type the inlet and and exhaust ports in the cylinder are arranged alternately while the sleeve ports serve for both inlet and exhaust. An example of an air-cooled cylinder with this arrangement is seen in Fig. 8. A cylinder liner is used and the four exhaust ports lead to Y-branched exhaust pipe on each side of the cylinder, while the inlet ports are in communication with an annular passage above the port line. This is an arrangement which is at present in production only in a racing motorcycle engine. It has advantages in absence of cylinder distortion due to the even distribution of heat, in fact that the annular passage forms an integral induction pipe suitably heated to assist vaporization, and because the position of the ports promotes inlet gas turbulence and breaks up the exhaust. Incidentally, too, a smaller valve shaft throw is required for a given port area. The disadvantages are: intricate coring of the cylinder, and the difficulty of collecting the exhaust gases into a common manifold when a multi-cylinder engine is in question.

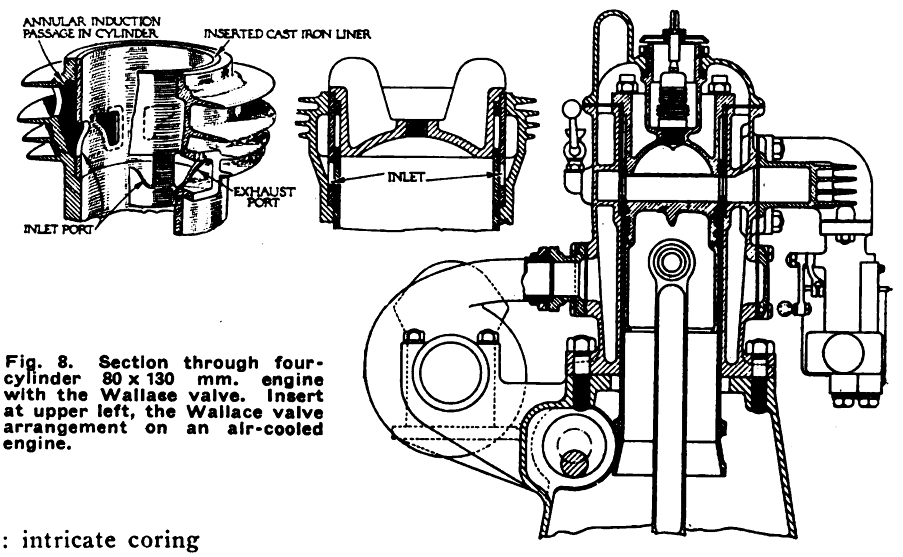


Fig. 8. Section through four-cylinder 80 x 130 mm. engine with the Wallace valve. Insert at upper left, the Wallace valve arrangement on an air-cooled engine.

Construction of the Sleeve Valve

A port which acts alternately as inlet and exhaust is advisable when maximum openings are desired, two single ports with a wall between would obviously use up more of the sleeve-valve circumference than a single double-purpose port.

The sleeve valve is usually centrifugally cast of good quality gray iron, and for engines up to 2¾ in. more is made 0.1 thick, while for engines of 4¼ in. bore a sleeve 0.25 in. thick is said to be quite satisfactory.

The valve timing varies according to the type and speed of the engine. Simplicity, silence and sustained economy are the advantages claimed for the single sleeve valve engine compared with the poppet-valve engine. The sleeve valve alone does the work of two poppet valves, two springs, two tappets, etc., and in the case of overhead poppet valves two rockers and two pushrods.

The cutting of ports in sleeve and cylinder is said to be a simple and speedy mechanical operation. The open-ended cylinder has advantages both in molding, machining and assembling. Valve covers, etc., are unnecessary, as the valve gear is totally inclosed in the engine body. The machined compression space is devoid of pockets or corners.

The rapid opening of ports reduces wiredrawing of the charge at high engine speeds to a minimum. Being positively driven the valve timing is constant at all speeds.

Bullard Introduces New Carbureter

For some months the Bullard Machine Tool Co., Bridgeport, Conn., has been engaged in development work, the fruits of which have been disclosed in the Bullard Process carbureter. Deliveries are now being made of this product as designed for Fords and Maxwells; Dodge and Chevrolet models are now in preparation.

Particular effort has been directed to providing a combustible mixture. Liquid fuel is brought from a conventional float chamber through a controlling needle valve into an atomizing orifice, where it is violently projected into a super-heated gasification chamber and there converted into a super-heated, dry, hydro-carbon gas.

Gasification chamber consists of a baffled passage, jacketed for surrounding circulation of hot exhaust gases, the baffles consisting of through ducts for these gases. The chamber provides two stages of gasification for the fuel, the more volatile or "lower end" portions being passed after the first stage to the outlet nozzle. Remaining portions which require additional heat for complete gasification are led thropgh second stage before reaching outlet.

The fuel in a dry, gaseous state is drawn through the main venturi orifice at which point it meets with the air portion of the charge. Air entrance is provided with a valve operated mechanically in conjunction with the throttle and not by the suction of the engine. This valve is set to balance the proportions of fuel and air properly under all conditions of speed and load. Air portion of the charge is admitted directly from the atmosphere, thus producing a cool mixture which makes for high volumetric efficiency. Time of association between the hot, gaseous fuel and the cool air is not sufficient under any prevailing atmospheric temperatures, either summer or winter, to permit any condensation before compression and ignition. This product will be pushed by the company in connection with the Bullard single face bumper, the Bullard double-faced bumper, the Bullard multiple dry disc friction clutch and a recoil governor that control spring action in both directions.

Lumber Economy and Standardization Desirable

Reduce Wastes and Save Valuable Hardwood by Careful Planning, Says Engineer—Standardization Progress

BODY production costs can be reduced materially and considerable money can be saved by body builders, according to Frederick F. Murray, who read a paper on "Needless Hardwood Lumber Waste" before the recent annual meeting of the Society of Automotive Engineers, in New York. He claimed that much of the present difficulty, causing waste, lies in the deficiencies of the present grading system, which was established years ago and which has not been changed to meet current automotive demands.

Revised specifications for grading would better the situation materially. Automotive manufacturers should cooperate with the hardwood producers in simplification and clarification of hardwood standards.

"Both the producer and the consumer of hardwood," Murray said, "would be provided with a simple yardstick measure of lumber values, and the easy application of such standards would do much to remove many of the difficulties that are experienced in interpreting and in the functioning of the present grades." Murray illustrated the possible simplification process by showing the following specifications of No. 1 Commons on the present grade basis and in the suggested simplified form:

No. 1 Common (Present Grade Basis)

Bright sap is no defect in the common grades.

Widths 3 in. and greater, not to exceed 5 percent of 3-in. widths.

Lengths 4 ft. and greater, but not more than 10 percent, may be 4, 5, 6 and 7-ft. lengths.

Pieces 4 and 5 ft. long, must be clear.

Pieces 3 and 4 in. wide, 6 and 7 ft. long, must be clear.

Pieces 3 in. wide, 8 to 16 ft. long, must work 66⅔ percent clear-face in not over two cuttings; no cutting to be less than 3 ft. long by the full width of the piece.

Pieces 4 in. wide, 8 to 16 ft. long, must work 66⅔ percent clear-face in not over two pieces in cuttings 2 ft. and over long by the full width of the pieces.

Pieces 6 ft. long, 5 to 8 in. wide, may have one standard defect; pieces 6 ft. long. 9 in. and over wide, may have two standard defects.

Pieces 5 to 7 in. wide, 7 to 11 ft. long must work 66⅔ percent clear-face in not over two cuttings; pieces 5 to 7 in. wide, 12 ft. and over long, must work 66⅔ percent clear-face in not over three cuttings.

Pieces 8 in. and over wide, 7 to 9 ft. long, must work 66⅔ percent clear-face in not over two cuttings; pieces 8 in. and over wide, 10 to 13 ft. long, must work 66⅔ percent clear-face in not over three cuttings; pieces 8 in. and over wide, 14 ft. and over long, must work 66⅔ percent clear-face in not over four cuttings.

No cutting to be considered which is less than 4 in. wide by 2 ft. long, or 3 in. wide by 3 ft. long.

Simplified Specifications (Suggested as to Form Only)

Primary Determining Factor—4 in. and over wide, 48 in. and over long, clear face.

Secondary Determining Factor—4 in. and over wide, 24 in. and over long, clear-face. Each board must contain not less than 50 percent primary factor and yield a total of not less than 75 percent of primary and secondary factors combined.

Along the same lines, the hardwood lumber standardization project of the Hardwood Manufacturers' Institute, Chicago, received strong forward impetus through the presentation of this project to the Society of Automotive Engineers and the designation of the Passenger-Car Division of the Standards Committee to receive and pass upon it.

This division was assembled at Detroit recently and addressed on this subject by F. F. Murray, advisory mechanical engineer of the institute.

He outlined the hardwood production situation and described the institute's part in the general lumber standardization project that was largely inspired and sponsored by Secretary Hoover of the Department of Commerce, and by the National Lumber Manufacturers' Association.

Mr. Murray said:

The Hardwood Manufacturers' Institute is national in scope, its membership comprising strictly hardwood producers and saw-mill operators whose output represents about 35 percent of all hardwood lumber produced in the United States.

Standardization of lumber sizes and cutting-up sizes for various purposes and of improved grading specifications is a problem requiring the cooperative effort of the producers and consumers, and the Hardwood Manufacturers' Institute is endeavoring to establish that cooperation with the consumers to remedy the admittedly unsatisfactory conditions that now prevail.

The consumers of hardwood lumber are not alone in their complaint as to conditions within the hardwood industry as they exist today, as the producers suffer likewise. The cardinal purposes of the institute are to secure adequate standardization for grading of hardwood lumber, guaranteeing the quality of shipments and meeting the consumer's requirements as fully as possible; to obstruct misrepresentation in grading, grade substitutions and the many forms of trade practice that at the present time reflect seriously on the industry.

The present methods of grading hardwood are inadequate. The top grade of "firsts" and "seconds" is determined by specifying a permissible number of defects in the boards; for example, in a board 15 in. wide and 16 ft. long, five standard defects such as 1¼-in. knots, etc., are allowed, without regard to the location or relation of those defects. Obviously the factory man is interested in what he can get out of the boards in the cut-up sizes he wants and in the quality he gets, not merely in the number of defects in the board.

The project under study is based on general factory cut-up sizes in which requirements as to quality become the units of consideration instead of the entire board being the grading unit as at present.

The present methods of grading were established over a quarter of a century ago, long before the general use of the automobile and the products of many other large and specialized consumers of hardwood lumber. The present

rules have not been changed in hardly any particular since then and are obsolete and inadequate in view of the tremendous developments in the hardwood consuming industries.

A thorough study is necessary of the hardwood requirements of the major consuming industries, including furniture, automobiles and trucks, agricultural implements and many others, so that whatever new standards are developed will serve all of those industries to the best advantage.

Lumber, like many other raw materials, is in a sense already manufactured by nature. The problem is to establish methods of grading and distributing so that each industry can get that part of the tree which it can use to the best advantage.

This will eliminate unnecessary waste and provide a substantial saving to both consumer and producer aggregating many millions of dollars per year and the conservation of millions of feet of standing timber.

The program also anticipates the building up of a satisfactory market for the lower grades of hardwood lumber, which, with prices based on supply and demand, will place the low grades in the scale with top grades and arrest the widening spread between top and intermediate or low grades of hardwoods. It is believed that therein lies the only answer to the complaint against high and increasing prices for top grades of hardwoods of which there is an actual scarcity in comparison with the lower grades.

The general organization of the lumber standardization movement is centralized in the Central Committee on Lumber Standards, the organization of which was completed last October. This committee, having headquarters in the City of Washington, is an executive body representing the several branches of the lumber industry in its entirety. Uultimately the standards which the participating producer organizations develop in cooperation with the consuming industries will be grouped into a comprehensive American lumber standard.

Following Mr. Murray's address, discussion indicated that the body building branch of the automotive industry is more interested in this project than any other one branch, although the motorboat, airplane, tractor, and some more specialized branches of the industry are probably interested to a lesser extent. It was not felt by the members that the society as such should endeavor to gather data and attempt to formulate standards covering the production of hardwood lumber, but that the better method would be to organize a subdivision to serve as a point of contact between the automotive industries and the Hardwood Manufacturers' Institute and to assist the institute in an advisory capacity, providing a channel through which the Hardwood Manufacturers' Institute can obtain data is so desired. Mr. Murray stated that the view of the situation taken by the members of the division was the same as that of the institute and that such an organization representing the automotive industries would greatly assist in the successful completion of the program inasmuch as the automotive industry has grown to be one of the largest hardwood consumers.

George E. Goddard, chairman of the passenger car division, has appointed the following subdivision to serve in this capacity.

George J. Mercer, chairman, Detroit.
C. W. Avery, Ford Motor Co.
R. A. LaBarre, Towson Body Co.
F. F. Murray, Hardwood Manufacturers' Institute.
Carl Simmons, Fisher Body Corp.

Inasmuch as this project will probably constitute a very important step toward the conservation of the available hardwood lumber resources of America and consequently tend toward a reduction in the cost of hardwood lumber, it is urged that all members of the society representing hardwood consuming companies cooperate as fully as possible with the society or the Hardwood Manufacturers' Institute when they are asked to furnish data and information regarding their hardwood lumber requirements.

Automobile Body Builders Hear Plea for Standardization

The Automobile Body Builders' Association, at their annual meeting in New York on Jan. 12, discussed railroad freight rates, changed their by-laws to abolish the term "associate member," elected officers for the coming year, and listened to three excellent speeches, one a plea for standardization, and two dealing with topics affecting automotive business in 1923.

A plea for cooperation in the creation of body engineering standards formed the subject of a talk given by L. Clayton Hill, assistant general manager of the Society of Automotive Engineers. There are a great many details of body construction and hardware that are susceptible to standardization without interfering with the designer's individuality. Attention was called to the recommended practices already adopted by the S.A.E. on door lock handle squares, door flange widths, top iron threads, etc.

Hill pointed out the importance of standardizing on certain types of rolled moldings. There is no need, he said, for 50 styles of drip moldings where two at most would suffice. The same is true of floor board, angle moldings and other similar parts.

There is the closest cooperation between the Automobile Body Builders' Association and the Society of Automotive Engineers in the work of body standardization. The committees of both organizations overlap, Hill said, and are always in contact. The A.B.B.A. committee has submitted a number of valuable suggestions which have originated among the members of the association for consideration by the body division of the S.A.E. standards committee.

Alfred Reeves, general manager of the National Automobile Chamber of Commerce, told the body builders that there will always be a place in the automotive industry for the small concern, despite a tendency toward centralization.

John C. Howel of the Brookmire Economic Service spoke on "Financial and Business Conditions Affecting the Automobile Industry."

The following officers were elected: President, Francis D. Willoughby of the Willoughby Co.; first vice president, A. W. Franz of the Waterloo Body Corp.; second vice president, L. P. Valentine of Valentine & Co.; third vice president, W. R. Laidlaw of the Laidlaw Co., Inc.

Plans 1,800,000 Fords for 1923

Ford Motor Co. has laid out a schedule calling for the manufacture of 1,800,000 cars in 1923. This is an increase of 450,000 as compared with 1922's output, when the figure of 1,352,479 was reached.

Body Show Has Good Trade Response and New Forms

Second Annual Show in New York Successful Despite Adverse Weather and Trade Conditions—Five New Body Styles Shown.

MUCH encouragement was given to the separate shows for body builders and body building parts and materials recently held in New York, when the second annual display of the Automobile Body Builders' Association, held at the Twelfth Regiment Armory, turned out a small but deeply interested (and buying) crowd, both attendance and interest surpassing last year.

Not alone were the bodies shown a source of much attention and interest but the fitments, construction and materials, and the finish and materials for producing finish as well. From the number of exhibitors, their prominence, and the variety of lines the fact was apparent. It was even more strongly emphasized upon analysis which disclosed the advancement of the art of body building and trimming which was reflected in the products that were displayed.

This was to be expected from the encouragement which has been given during the past year to firms serving the body end of the trade. The response of the market to well proportioned and finely fitted cars has been definite, and this has extended even into the ranks of lower priced quantity built cars. So far as the higher price ranges of vehicles are concerned the impetus thus given has served to bring out equipment and fittings of which their makers are proud.

The pride is no less, but is of slightly varied character in some other directions where the constant urge to make things better has been tempered with an equally severe requirement to make them cheaper. The upholstery man has some exceedingly fine fabrics which have been called into being by the demand for something new. So has the hardware and the paint expert. The market for fabrics and hardware and paint for larger production schedules naturally falls slightly behind that of the higher priced jobs, but this is only comparative.

The net of it is that those who supply the things that go into automobile bodies are building better, are offering it in improved patterns and in greater variety than was possible before the present good market came on. Where quantity has been the attraction they have been such as to command and get the best efforts of those who supply them. Where the markets have been less as to quantity, the list price of the finished vehicle has been such as to permit a margin sufficient for the highest grade of workmanship.

Five novel bodies were of special interest. The special jobs, shown by Hume, Holbrook, Willoughby, E. J. Thompson, and Ellerbeck, all had novel features from the standpoint of body design.

Hume showed an attractive coupe mounted on a Marmon chassis, which one visiting engineer referred to as an "inclosed roadster." The unusual lines of this job include the roof in one piece with the back panel and carried over to the front. The visor effect is gained by extending the roof well forward. Aluminum was the material of which the roof is constructed.

The rear deck lacked the conventional door at the top. Instead, entrance to the luggage space was through a side door on the right, just forward of the mudguard.

Holbrook showed a brougham mounted on a Packard chassis.

A sedan mounted on a Studebaker chassis was shown by the Willoughby Co. This car had a trunk rack at the rear and a spare wheel forward.

Two bodies were shown by the E. J. Thompson Co.; both were four-passenger coupes. One was mounted on a Westcott chassis.

The Ellerbeck convertible body was exhibited. This job has a metal top which rests flat over the rear deck when in its lowered position. This double use of the top is obtained by shifting the top bodily from one position to the other on rotating arms fastened to the sides of the car. When the top is in the lowered position it forms a continuation of the body in the rear seat, the edges of the top fitting into a recess in the body surface to preserve unbroken body lines. The design is such as to allow a spare wheel to be mounted in back of the seat.

All of the bodies at this exhibit were exceptionally good examples of fine workmanship and enough construction details were shown to enable interested observers to see the refinements in building.

A taxi body trimmed with Zapon leather cloth was shown by the Zapon Leather Cloth Co. This body was exhibited on a Wire-On molding, covering the joint at the drip and belt. This molding was made by the Carter Co. and constituted a good example of a wide variety of molding made by the same company for edging finish with fabric covered quarter and rear panels.

Interesting exhibits of window regulators, door locks with improved locking devices, and body hardware were made by Perfection Window Regulator Co., Parsons Mfg. Co., English & Mersick Co., National Seal Co., E. V. B. Co., Dura Co., Abeles-Lewit Co., Art Work Shop, Charles C. Blackmore Co., George R. Carter Co., Cleveland Hardware Co., Doehler Die Casting Co., Eberhard Mfg. Co., O. M. Edwards Co., Inc., Mack Lock Co., Inc., Mitchell Specialty Co., Russell & Erwin Mfg. Co., Soss Mfg. Co., Stewart Mfg. Co. Other exhibitors showed paint and varnish, leather, leather cloth, interior trimming cloth, and other materials of body construction.

Among those exhibiting materials of this kind were the following: American Chemical Paint Co., Black & Decker Mfg. Co., Blocksom & Co., Sidney Blumenthal & Co., A. Boyriven, Bridgeport Coach Lace Co., Brunsene Co., A S. Campbell Co., Carr Fastener Co., Cleveland Tanning Co., D'Arcy Spring Co., Dictograph Products Co., W. H. Duncan Co., Inc., Eagle-Ottawa Leather Co., FitzGibbon & Crisp, Inc., Gallaudet Aircraft Corp., Haskelite Mfg. Corp., Laidlaw Co., Inc., Lesher-Whitman & Co., Inc., Louisville Bedding Co., Manning Abrasive Co., Marshall Metal Corp., Minnesota Mining and Mfg. Corp., Murphy Varnish Co., Oxford Varnish Co., Pantasote Co., N. A. Petry Co., Inc., Radel Leather Mfg. Co., R. E. Rodriguez, Sherwin-Williams Co., Textileather Co., Valentine & Co., Zapon Leather Cloth Co.

The Body Builders' Show this year was of more interest as an accessory and parts exhibit than as a style show. Since the public is likely to be more interested in the lat-

ter type exhibit, future shows will probably give more attention to design and style of completed bodies.

Efforts will be made next year, it is understood, to make the Body Builders' Show more complete as to body designs. The attempt will be to interest more fully the general public and the members of the industry visiting the New York Automobile Show. The Body Builders' Show has suffered in attendance because of the automobile show in the past, especially because of the numerous hotel and other exhibits, all of which make calls upon the time of the interested visitor.

Closed Car Demand Increasing

The marked trend toward an increased use of closed cars is indicated by the replies to a questionnaire recently sent out by the National Automobile Chamber of Commerce. This was circulated among 20,000 car-owners and 60 percent of the replies stated the buyer's next purchase would be an enclosed model. The principal reasons given in the replies were protection from the weather, general comfort, all-year use and a better appearance. In Massachusetts, Illinois, Wisconsin, Iowa, California and Pennsylvania the vote for the closed car was well over 60 percent while in the southern states the demand was less marked, only 40 percent of the owners in Alabama, for example, being in favor of the closed car.

A large number of the replies gave several reasons for the owner's preference. Protection from the weather was listed as one of the factors in 44 percent of the replies, although general comfort, which ranked next with 34 percent of the replies, includes not only protection from the weather but also freedom from dust as well as easy riding qualities. In mentioning economy, which represented the main reason in 20 percent of the replies, some of the owners emphasized the point that in addition to being able to use the enclosed car throughout the entire year, the expense of extra heavy clothing needed for the open models for use in the winter time was eliminated. The inconvenience of side curtains was mentioned by 4 percent of the owners preferring closed cars as the reason why their next purchase would be a closed vehicle.

On the other hand, the answers to the questionnaire revealed several strong factors that will keep the open models in popular favor. These include poor roads which was mentioned by 23 percent of the replies as being an objection to closed cars; the price differential, lightness, safety, more air and business utility. Although the price differential is much less now than it was 2 or 3 years ago, 16 percent of the replies gave this as the reason for purchasing an open type of automobile. Lightness with a resulting lower upkeep cost was emphasized by 15 percent. Closely following these two factors was the unforeseen argument of safety. In the replies favoring the open car 14 percent of the owners gave this as a reason, expressing a fear of cuts resulting from broken glass and an objection to being closed in in case of accident. The fresh-air advocates were represented by 13 percent of the replies and 10 percent emphasized the utility of an open car for business use. The replies from the farming districts in particular indicated that the phaeton was more of a utility vehicle as it can be readily used for cartage and it is also possible to drive it over fields with less inconvenience than would be the case if an attempt were made with a closed car.

Keen Interest in Argentine Auto Show

Eighty thousand persons, or twice as many as last year, visited the fifth annual automobile show held in Buenos Aires, Nov. 10 to 19, under the auspices of the Argentine Automobile Club. The automobile trade has developed so rapidly that there is no building in the capital capable of housing a complete display under one roof, and the lack of sufficient space this year prevented a number of agents from showing a complete line. The exhibit of trucks, tractors, accessories, and miniature assembling plant of a low-priced American car were placed under canvas apart from the main salon.

Twenty-six American manufacturers of motor cars were represented, either through agents or by factory branches, as against five French, four German, three British, and four Italian. The increase in number of American exhibitors and the absence of several English, French, and Belgian makes, which apparently have ceased to be factors in this market, is evidence that American cars are gaining a greater foothold.

Of all the exhibitors, the Italian Fiat was the most prominent and complete. This company is making a very strong effort to push sales and, on recent tenders for trucks for the public works department, successfully underbid all competitors.

The showing of trucks was weak, and the absence of a number of well-known American makes was very noticeable. The gradual construction of roads and a large increase in crop averages should greatly stimulate truck purchases.

Several German heavy-duty models attracted much attention, particularly on account of price. A number of French trucks also were shown.

The accessory exhibit was unusually large and comprehensive, most of the articles coming from the United States.

Argentine body builders demonstrated their ability to compete with both American and European by the high degree of craftsmanship embodied in their products, which were mounted on Lancia, Wolseley, Renault, and American chassis.

Fourteen European and 26 American cars (excepting one low-priced make) valued at 500,000 pesos (paper), were disposed of on the floor, and agents report continued purchasing, which they attribute directly to the interest created by the show.

Auto Makers May Use More Nonferrous Metals

It is expected that more copper, nickel and aluminum will be consumed by manufacturers of automobiles in 1923 than in 1922, and some orders for zinc sheets already have been placed by automobile makers.

At the automobile show at New York, nonferrous metal trades were well represented, but the iron industry was less conspicuous. Representatives of nickel and zinc manufacturers and practically every aluminum broker and importer were in attendance.

It is possible to utilize a larger proportion of nonferrous metals in construction of automobile cars, because through skillful management labor waste has been eliminated to a large extent, reducing cost of production.

Engineering Department Requires High Organization

Some interesting figures and striking examples of the high state of organization of the engineering department of a large automobile factory, collected by Ernest W. Seaholm, chief engineer of the Cadillac Motor Car Co., have recently been made public.

There is on file in the engineering department of that concern approximately 80,000 drawings, all of which are recorded in such a manner that they can be found on a few moments' notice. Nearly 200,000 blue prints covering actual construction and experimental work are issued in the course of 12 months and the blue print paper used would more than cover a 10-acre farm.

The most minute change on a part which is represented by a drawing requires recording, and the issue, on an average, of 35 prints in each instance to replace prints in existence prior to the change. Under no condition is an obsolete print permitted to remain in the hands of the production departments, nor is any deviation from specifications permitted, either as regards dimensions or material, except on a written deviation permit from the chief engineer.

The engineering department occupies the four floors of an entire wing of one of the big factory buildings, is subdivided into several departments, and employs a large force of men highly trained in the automotive industry, most of them through many years of service.

These men are forever asking questions and answering them in the engineering laboratories.

All the materials intended for the car must be investigated. They run the gamut from hair to hickory, rubber to steel, and from fabric to paint, felt, cork and what not. This takes members of the department into fields of metallurgy, mathematics in all its branches, hydraulics, gases, electricity, physics, chemistry—and even into the field of art.

New materials also, and devices that have any promise of benefiting the product, are under constant investigation. In fact to be really successful an automotive engineering department must be more inquisitive than any 10-year-old boy.

Output Nearly Double 1921

Production of cars and trucks in 1922 nearly doubled the previous year's figures, according to Department of Commerce statistics. Total output was 2,334,171 cars and 243,049 trucks, subject to slight revisions on final reports. The department's 1921 figures were 1,435,161 cars and 147,000 trucks.

The government figures are compiled from reports received each month from identical companies, including 90 car and 80 truck manufacturers. December output, it is shown, was 206,418 cars and 20,138 trucks, close to three times December, 1921, production. It was slightly less than that of November, 1922, however, when 214,632 cars and 21,627 trucks were reported.

Ford Passes 7,000,000 Mark

Ford Motor Co. has turned out its 7,000,000th automobile. The car was produced at the Highland Park plant on Jan. 12.

General Motors' New System of Handling Funds

General Motors Corp. now has in effect a system of cash collection and distribution and credit management that serves its 33 manufacturing organizations, 28 sales companies and 10 miscellaneous units almost precisely as the governmental bank acts in behalf of its members.

The central management has inaugurated telegraphic sending of funds in place of using the mails, with the result that financial statements can be prepared less than a day behind actual conditions. Reduction of funds in transit has reduced interest charges almost to nothing. Working capital is available almost instantly to meet any manufacturing need of any unit, incidentally relieving that unit of the necessity of holding idle funds.

When any unit's balance rises above a certain point, the bank itself telegraphs the funds to the treasurer of General Motors, using for the purpose the Federal Reserve Bank and the sums are credited by the corporation to any one of the many banks in New York and Detroit used by the central organization itself. Thus the treasurer, notified by telephone or telegraph, of the arrival of such items, may request immediate transfer of the funds thus available to any bank in any one of the 33 cities where units are located and disbursing accounts maintained.

This system has rendered General Motors funds more fluid since managers of units, knowing that the less cash retained the higher the percentage of return on working capital, are glad to dispose of surplus funds into the common pool.

Inter-company billing and remittances have been reduced to their simplest terms with a consequent vast saving in clerical labor and further reduction of the amount of funds in transit. Raw materials, naturally, may pass through half a dozen units of General Motors before being sold in the finished car. Under the new system, the units do not bill one another for parts or materials purchased; instead, each unit receiving materials sends to the General Motors clearing house in Detroit a credit slip in favor of the delivering unit.

General Motors Profits for 10 Months

General Motors Corp. and subsidiary companies returned for the 10 months ended Oct. 31, 1922, net profits of $49,406,542, after charges and federal taxes. General Motors' proportion thereof was $49,100,062. Debenture and preferred dividends amounting to $5,296,031 left a surplus for the period of $43,804,031.

Net earnings for the 10 months were $59,605,075. Employes investment fund, $1,150,320; interest, $1,308,213; federal taxes and the like, $7,740,000, left net profits at $49,406,542.

Wills Statement

Receiver's statement of C. H. Wills & Co.'s financial condition shows total assets of $5,181,942 consisting of cash, $6,403; notes receivable, $11,106; inventory, $1,593,-992; lands, buildings, machinery, etc., $3,427,149. Liabilities are scheduled as follows: loans and mortgages, $247,-731; accrued payroll, taxes, etc., $105,068; notes and acceptances, $479,361; accounts payable $1,945,065; dealers' deposits, $9,980; revolving credits, etc., $5,941,614; dealers' reserves, $36,234; total $8,765,053.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIV JANUARY, 1923 No. 10

The Big Show Very Successful

THE first of the big automobile shows, the national display at New York, which always represents the announcing time and place for the new models of 1923, was unusually successful.

A marked fillip in the direction of entirely new things was given by the announcement of the new General Motors air-cooled car, the new Chevrolet four. This is the socalled copper cooled engine which has been attracting so much attention in and around Detroit for the past year. It has been dubbed this because of the fact that cooling is by means of radial copper fins and an external cylinder surface of copper. The engineers responsible for it claim to have perfected a process by means of which the copper surface and fins are permanently united with the cast iron forming the body of the cylinder. Whether this is really a chemical union, produced in the foundry or by welding, or is only a mechanical supposition remains to be seen.

Incidentally the annex show for Madison Square Garden included the Page, an air-cooled car with an engine designed along aeronautical lines and the D. A. C., a four-cylinder V-type motor of small included angle, and said to have some remarkable new features.

A number of novelties, designed, or at least intended, show included Stanley, and the annex had among its exhibitors the Coats and the Gearless, new types of steamers.

A number of novelties, dessigned, or at least intended, to reduce weight and to increase operating economy, were shown. Designers undoubtedly received a number of new ideas from the show, as well as from advanced owners.

The general public saw the finest lot of modern cars it has ever seen at one time and place, and undoubtedly glorified in the price cutting. Several makers announced fair-sized reductions on the eve of the show opening, while all the new models to be shown for the first time were priced on remarkably low levels, as for instance, the new Nation six, at $795. This coupled with the half dozen important reductions in the past three or four weeks, will undoubtedly force a considerable number of other revisions.

While the show is no longer press-agented in the old manner, it undoubtedly lived up to the former claim, made annually, of the biggest and best. The crowd was greater than ever before, and new attendance records were set from day to day and for the whole week, in fact the doors were closed several times. Buying was on an unusually heavy scale judging from that of the recent weeks, December having been the biggest December in the history of the industry.

More than the show itself, it is expected to usher in the industry's greatest year. Practically all manufacturers can apply this adjective to 1922, and they are doubling or otherwise increasing their building plans over that previous best. General business predictions for a very prosperous year would seem to make such a thing more than possible, while the success of 1922 would seem to make it probable. Hence, the importance of the Big Show which ushered in all this progress and prosperity for the country's second largest industry.

Chicago Salon Displayed Three New Cars

Two new American cars and one old German car appeared for the first time as special features at the eighth annual Chicago Automobile Salon which opened on Jan. 27 at the Drake hotel. Five nations were represented among the 17 makes of high priced chassis shown. Intended to meet the special requirements of city traffic and therefore aptly termed a Voiture de Ville, the new Leon Rubay made its Chicago debut at the salon.

The German car, appearing on exhibtion for the first time in Chicago is the Benz, best known in this country for its speed records on the Ormond-Daytona Beach. The latest model is a fine example of German post war design and engineering. The various makes shown at Chicago were Benz, Cadillac, Cunningham, Daniels, Duesenberg, Fox, Isotta-Fraschini, LaFayette, Leon Rubay, Lincoln, Locomobile, Marmon, Minerva, Packard, Rolls-Royce, and Winton. De Causse, Fleetwood and Kimball had special custom coachwork exhibits.

Willys Given Windshield Judgment

Willys-Overland Co., Inc., was awarded a judgment for all profits made by the Troy Carriage Sunshade Co., by the sale of the Webster windshield, which the court, at Toledo, holds is the exclusive property of the Overland Co. The suit was originally brought by the Troy company, which charged infringement against the Overland and the Kinsey Mfg. companies.

Moto-Meter Granted Injunction

Judge Bodine, in the U. S. district court on Jan. 22, granted a preliminary injunction against the Pyrene Mfg. Co., restraining it from manufacturing or showing a device called the "Guardene," which was exhibited at the recent New York show. Harrison H. Boyce and the Moto-Meter Co., Inc., brought suit claiming the instrument made, or about to be made by the Pyrene Co. was an infringement on their patents. This is the second suit which Moto-Meter has instituted within the past month, the other being a libel suit for $300,000 against Autometer Co., Long Beach, Cal.

Lighter, Cheaper Bodies Through New Type of Construction

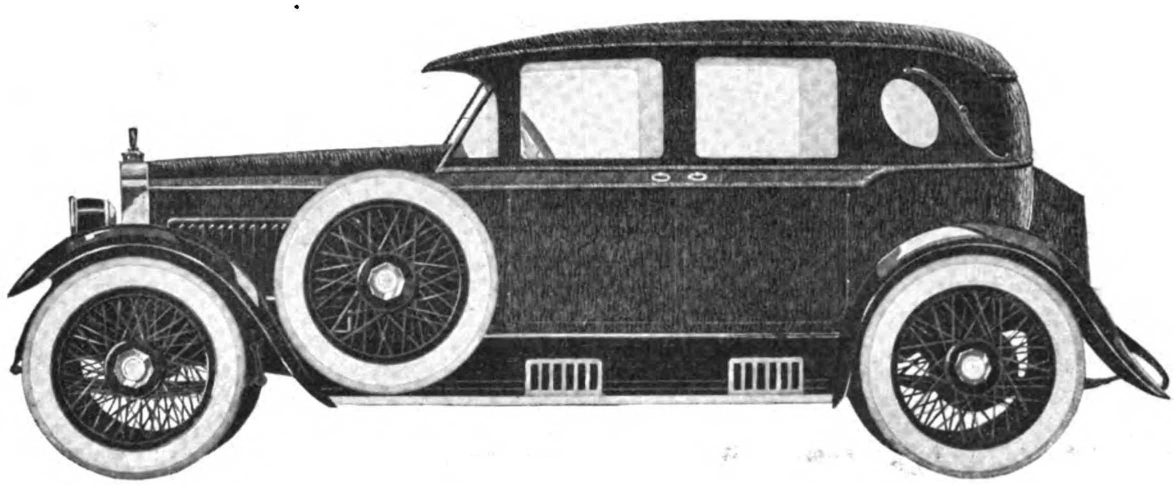
Entirely New and Different Form of Body Construction Includes Use of Fabric Exterior Surface Over Wood Frame and Wire Reinforcement

UNDOUBTEDLY one of the greatest advances in motor vehicle construction, and certainly the real surprise of Automobile Show week, was the new Meritas fabric body. Coming at a time when all manufacturers are attempting in every way possible to reduce weight, its saving of 10 percent and upwards on the body alone should be sufficient of itself to warrant giving it more than an ordinary reception. But this is only one of its many forward-looking features, and by no means the most important. When one adds to reduced weight a considerable cut in manufacturing cost, improved appearance, economy of operation, ease of repair, partial elimination of vibration and thus increase in riding comfort, and in that way decrease in noise,—or put the other way, greater quiet and claimed greater strength, it will be seen at once that the body is more than a novelty and offers real advantages which must have serious consideration.

In brief the construction, as it was shown in the lobby of the Commodore Hotel on a Packard chassis, consists of an outer surface entirely of fabric, this being an imitation leather. It is stretched over a foundation of wire and buckram fastened to the conventional wood framing. ness. The wadding between wire and buckram prevents any possible rubbing of these two stiffer members, and obviates the possibility of noise arising from this source.

The frame work is double rabbeted, with one rabbet for the wire and one for the buckram. The latter is made wider so as to have the buckram cross the joint and be nailed beyond the wire edge, thus making the buckram construction somewhat independent of the wire beneath it. It has the additional advantage of giving greater strength in that the two materials do not attach to the wood at the same but at different points. The window openings will be noted in the illustrations as having rounded corners. This is not a necessity but was done for the same reason, namely, to allow the fabric to be carried over and fastened to the inside at a different point, and without cutting the goods.

The fabric, a rich lustrous deeply-grained imitation, is stretched over the buckram, being put on much as any leather upholstering is. The body shown in New York has an additional layer of wadding between buckram and fabric but this was done solely to obtain a rounded appearance, distinctly different from the smooth flatness of metal



The Meritas-covered finished body mounted on Packard chassis.

In constructing one of these bodies, the work progresses as follows, and as shown by the accompanying figures.

First, as shown in Fig. 1, conventional wood frame work is erected, using the same size of posts, pillars and cross members as in other forms of construction. Then when this is completed the wire which forms the basis of the construction is applied, as shown in Fig. 2. This is a No. 19 two-mesh wire, that is two meshes to the inch, and is fastened with staples, or if necessary or desirable, with screws. It is heavily galvanized, which makes it rust-proof and permanent, added to which is the incidental advantage that the galvanizing process fills up the corners where the wires cross so as to make it considerably stiffer and stronger.

Over this wire is laid a rather thin layer of cotton wadding. On top of this is placed the buckram, which is really a three-ply burlap, approximately 3/32 in. in thick- plates. The wadding again has the advantage of smothering noise, of preventing wear between fabric interior and buckram exterior surfaces, and others, but it is pointed out by the makers and developers of this body that it is not a necessity.

Omitting this, and stretching the leather tightly a reasonably smooth exterior would be obtained, but even this would lack the flatness of the all-metal body or the wood with metal panels.

The leather exterior will always give a different and richer appearance than either metal or wood. This construction whether carried through wholly or in part will have a largely-leather surface. In this it will match the older carriage bodies. It will be remembered that the finest coach bodies of early days were constructed with top and quarters of leather.

Strength and durability are included in the maker's

claims for the new form of body construction, which are given in detail later. Both are very important, for saving in weight at the expense of either would not be tolerated by the buying public. However, the experimental bodies constructed along these lines have stood the tests of two years continuous use without failing, are still in service, and the foundation leather is so well preserved after this two-year exposure to all kinds of weather that a little rubbing with a soft cloth will brighten it practically like new.

This and the ease of refinishing the fabric surface are strong claims to the average driver. Rubbing up with a

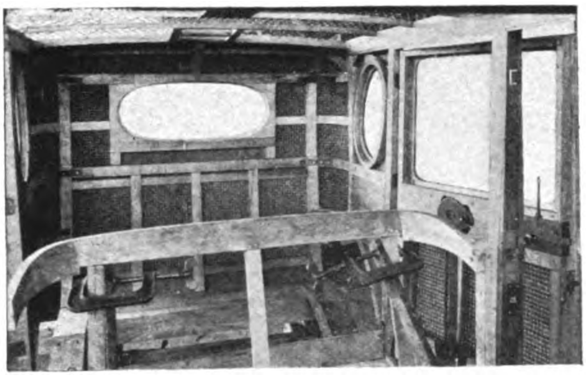


Fig. 1. Shows how wire, cotton and burlap are applied.

soft cloth and some leather renovator liquid will make the body look like new at any time, but granting a desire for an entirely new surface, the average man would be able to wash the surface clean, rub it dry and varnish it himself within half a day. The surface produced in this simple way should be practically perfect because of the fact that the leather takes the varnish coating so well. Comparison of this with the ordinary removal of old paint, the refinishing of the old surface and the gradual building up of an entirely new coat on wood or aluminum, and the new construction stands out as a remarkable advance.

Weight is, of course a very big item, as stated at the outset. The body shown indicated a saving, it was said,

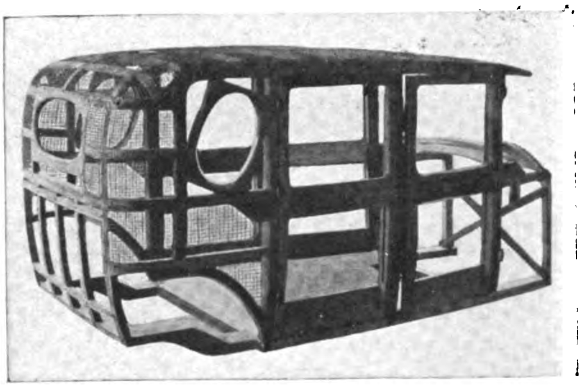


Fig. 2. Application of wire to frame.

of 350 lb. over the average Packard body on the single six, which with body weighs approximately 3,200 lb. This is on the enclosed body not the open phaeton. Inasmuch as this saving in pounds would be almost the same regardless of the size of the body, on a smaller job, as for instance a car of the 115-in. wheelbase group, the percentage of saving would run much higher than the 11 percent of this case, in fact it might easily run as high as 20 percent. And in combination with another big weight saver, as for instance the new Chevrolet copper cooled chassis, in which 140 lb. is saved, the total weight reduction of the combination might easily be so great as to be revolutionary in principle.

The weight of the combined wire, buckram, wadding and fabric is less than ¾ lb. per sq. ft. As stated before, the wood framing is the same for this type of body as for aluminum or steel panelled jobs. The steel body braces, the doors, roof and windshield are the same, in fact this body followed conventional light-weight metal panelled construction up to the point of application of the metal panels.

On the first body, the flat cost of covering and foundation material was 26 cents a square foot. Aluminum costs 30 cents and steel 7, but to the cost of both these must be added stamping or hammer cost as well as finishing and painting. Mill work and framing cost the same in the two body types but a great saving in finishing is effected with the fabric body. Two men finished the interior and exterior in two weeks with one day out for a holiday. The finishing too was easier and simpler, for at no time was it necessary to keep hands off the finished surface nor was it necessary to give any special attention to protecting the fabric surface. The finished body was transported

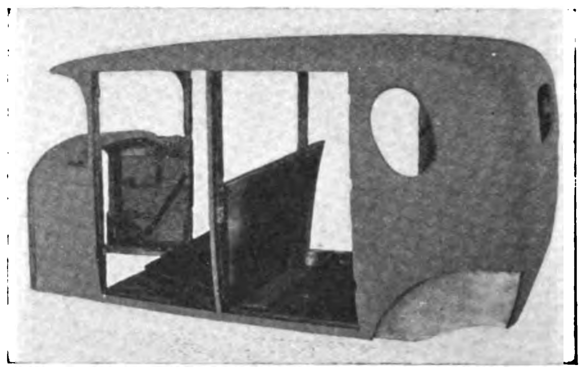


Fig. 3. Showing buckram fastened over wire.

without covering, as compared with considerable cost in protecting the finished surface of the ordinary wood or metal finely painted job.

This ruggedness of the surface combined with the simplicity of finishing is bound to make the new construction popular if nothing else does. From the time standpoint, there is much saving to the manufacturer. The time usually needed for painting is saved. The exterior of the body can be covered with fabric in a day, which is a gain of 5 to 11 days, according to the quality and materials usually used. Moreover, the design is most flexible, and can be changed as desired without changing expensive tools and jigs. As additional advantage is the ease of transporting, storing and using the rolled fabric as compared with wood or metal panels. Moreover, the form or contour of the body can be changed readily from straight to curved, or to part straight and part curved or otherwise as desired without expense or delay. When a panelled body of any form is changed from a straight to a curved or part curved surface there is delay, expense, new fixtures and jigs, other complications.

Over and above the advantages now apparent or claimed for the new form of construction, undoubtedly a large number of smaller but worthwhile advantages will develop during more extended use of this body.

Those advantages which the patentees of the process and makers of the fabric claim for the construction, and which appear to be well substantiated are:

Reduced Cost of Production—(a) The cost of raw materials used in the Meritas-made body is approximately one-half the cost of materials used in a metal body. (b) The time required in production of this body makes it possible to produce not less than three bodies in the time and with the labor now charged against one body of similar type, constructed of metal.

Economy in Operation—(a) A very important saving in cost of operation of a car equipped with the Meritas-made body is effected because of its difference in weight as compared to a metal body. Metal panels weighing about 1¼ lb. per sq. ft. are replaced by materials weighing less than ½ lb. per sq. ft.

Improved Appearance—(a) When new, the finish of the Meritas-made body is identical to the finish of a metal body in smoothness, luster and brilliancy. The construction of the Meritas leather cloth used on this body provides a permanency of finish which metal bodies do not possess. Meritas leather cloth has been used on a large number of passenger cars and busses for a number of years. This experience has demonstrated that dust, grease and mud will not mar the surface but can be wiped off easily, maintaining the original luster unimpaired. (b) The leather cloth panels used in the Meritas-made body do not expand or contract under variations in temperature. This factor eliminates the cracking and checking of varnish such as found on metal panels.

Increase in Comfort of Owner—(a) The Meritas-made

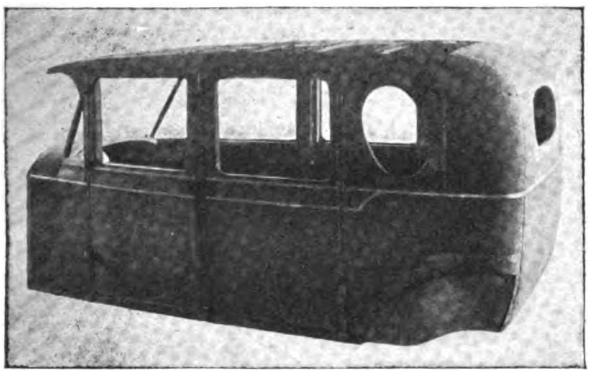


Fig. 4. Finished body ready for fabric.

body eliminates in large measure the drumming and vibration of a closed metal body. (b) The leather cloth used in the Meritas-made body is non-conductive of heat; therefore the fabric body is warmer in winter and cooler in summer. (c) The rattles and squeaks of a metal body are eliminated in the Meritas-made body; no metal rubbing against metal.

Ease of Maintenance—(a) Damage to metal bodies require long and expensive repairing. The painting operation alone requires weeks. The Meritas-made body can be repaired in a few hours by the substitution of a new, pre-finished panel in place of the one damaged. (b) In order to revarnish the Meritas-made body, it is necessary to only wipe off the surface and apply a coat of varnish; no burning or scraping off of the old paint is necessary to secure a perfectly smooth face. (c) The destroying effect of vibration and distortion which plays such a large part in the deterioration of a metal body is eliminated.

Strength of Body—The Meritas-made body being provided with additional strainers and wire fabric, forms a stronger and more rigid body than the present-day construction.

S. A. E. to Meet in West Next Winter

President H. W. Alden, in his inaugural address at the N. Y. meeting of the Society of Automotive Engineers held during show week announced that the next winter meeting will not be held at show time in New York, but will be held on some other date in the middle west. The next summer meeting will be held in the east either in the mountains or at the seashore, probably the latter.

A new plan has been adopted for strengthening the section activities. Considerable attention will be given to this phase of the society's program during the coming year.

The highway committee of the S. A. E. is now ready to function actively. Its work and scope have been determined, and it is ready to go ahead in a constructive way. Its chairman during the coming year will be the retiring president, B. B. Bachman.

Emphasis will be laid upon production engineering during 1923. The success of the Detroit production meeting last fall showed the need for such activities on the part of the society. Design and production work are to be tied together more closely.

At least one business session will be held in New York next year at the time of the New York show, in addition to the regular winter meeting which will be in the west. There is some thought of holding a single technical session at the New York meeting at which some very prominent foreign engineer may be asked to speak. Such a plan is not definite at this time, but has been suggested.

Auto Industry Third in Total Carloads

James S. Marvin, head of the traffic department of the National Automobile Chamber of Commerce, states that automobiles, trucks and parts, not including tires, rank third in the number of carloads — 382,945 — of manufactured articles shipped on railroads in the first nine months of 1922. Refined petroleum with its products is first with 810,137 carloads; bar and sheet iron, structural iron and iron pipe are second with 482,424, and cement is fourth with 371,045.

Figuring on the full year, Marvin declares that the automobile industry's total will exceed 500,000 carloads.

Factory shipping figures for the year show that there were 331,226 carload shipments of automobiles as compared with 195,478 in 1921. Driveaways totaled 304,758 as against 144,446 in 1921, while boat shipments were 58,213 as compared with 22,310 in 1921.

Of the 2,576,219 motor cars and trucks made in 1922, 1,232,112 were Fords, while Ford's production in December aggregated 115,629 out of the month's count of 225,000.

The decrease of total production under November is 5 percent; last year December decreased 35 percent under November. The increase of December, 1922, over December, 1921, was 200 percent.

Willys Creditors to Be Paid in Full

Willys Corporation affairs have reached the point where the statement has been made that all creditors will receive 100 cents on the dollar and that a small balance will be available for the preferred. Early in November a payment of 40 percent on indebtedness was made and another payment will be made soon.

Automobile Finishing-Varnish

BY L. VALENTINE PULSIFER[1]

LAST year before the Society of Automotive Engineers and the Automobile Body Builders' Association I discussed the Manufacture and Application of Automobile Varnishes and Paints[2] and Some Problems in Automobile Finishing.[3] These two talks covered the basic principles of the manufacture of varnishes and paints and the fundamental engineering problems involved in the building of a successful automobile-finish. At the conclusion of the second of these talks I made the following statement:

> I hope the points and problems I have discussed will arouse a greater desire to study this particular field of automotive engineering, both on the part of the automotive industry and on the part of the paint and varnish industry. A scientific study of the problems involved, by as many qualified groups as possible, will yield ample dividends of satisfaction to all concerned.

This plea for cooperative effort along the lines suggested has roused considerable interest; and an attempt is being made to substitute knowledge for the hit-or-miss methods that in the past have been all too prevalent. With a desire to assist in establishing automobile finishing on sound engineering principles I shall take up the subject of automobile finishing-varnish in greater detail than time permitted in the two talks mentioned above.

Automobile Finishing-Varnish

Assuming that the undercoats of an automobile-painting system have been properly selected and applied and that the finished car will receive intelligent and proper care from its prospective owner, the success or failure of the finish will depend on the finishing-varnish.

The fact that the finish of many automobiles, even those of the highest grade, does not last so well as did the finish on the fine carriages of a generation or two ago, has led some persons to believe that the general quality of finishing-varnishes has deteriorated. Such a conclusion is the reverse of the truth, for it is possible today to obtain varnishes of far greater durability and much greater resistance to abuse than could be obtained from 25 to 50 years ago. The conclusion, however, is not unnatural if one does not consider that the finish on an automobile, even with normal use, undergoes a treatment that the carriage finish would never have received, and that thousands of automobiles are finished with varnishes that in the days of the carriage would hardly have been used even for quick cheap repair work. When speed, cheapness and the need of covering-up defects in the rubbing-coats are the compelling motives, finishing-varnishes sometimes are used that hardly exceed in durability a good elastic rubbing-varnish; but this practice usually is due to a lack of knowledge of the consequences involved. Even when these are not the determining factors, a finishing-varnish frequently is used that represents perhaps a scant 25 percent of the maximum durability obtainable. Here, again, a lack of knowledge is involved, which, if it existed in the whole field of automotive engineering, would doom the automobile to hopeless failure. The use of a finishing-varnish with rubbing-varnish elasticity is about on a par with the use of cast iron for crankshafts, or white pine for spokes.

It is my purpose to describe the qualities required of a successful automobile finishing-varnish and the methods of determining whether these qualities exist in any given varnish.

Qualities to be Desired

The most desirable qualities of an automobile finishing-varnish must be determined by the automotive and varnish industries jointly, for each understands best the limitations under which it has to operate. Compromises must be made between what is desirable and what is possible. This is true of varnish as well as of steel, leather and other automotive materials; and it is only when both parties desire to produce the best that the ultimate in automobile finishing can be obtained. The selection of the finishing-varnish best suited to a given car, a given production schedule and a given method of application must be made after a combined study by the varnish manufacturer and the automobile builder.

To do this without great waste of both time and material, rapid methods of estimating must be used and the results of such estimating must be intelligently interpreted. The important qualities for convenience may be divided into two classes: (a) shop qualities and (b) service qualities; these will be taken up separately.

Shop Qualities

Shop qualities include color, body or viscosity, working, flowing, setting, hardening, fullness and the safety of working. To estimate them satisfactorily is easier than to estimate the service-qualities of an unknown varnish; and some of the qualities such as working, flowing, setting, hardening and the fullness of finish can be determined best in the shop itself under average shop conditions. By "working" is meant the possession of the proper working-properties for the method of application it is desired to use, whether by brush or by flow-coat. By "flowing" is meant the ability to flow-out properly without runs, sags, curtains or brush-marks, and yet to retain a suitable body of varnish on the finished surface. By "setting" is meant the ability to set slowly enough to allow the entire surface to become smooth and yet fast enough to prevent too long a flow, which sometimes permits the varnish to run over a molding or from an upper panel to a lower one. The "hardening" and "fullness' are estimated most easily on a body run through on the regular production-schedule, but the quality of hardness can also be determined satisfactorily by a laboratory test that duplicates shop drying conditions. The "safety of working," that is, the ability of the varnish to act properly under adverse shop conditions, is hardly an important factor in a modern automobile plant. For drying and safety-of-working tests, see Appendix 1.

The two other shop qualities enumerated above, color and body or viscosity, are best estimated by using the Gardner-Holdt viscometer, an instrument developed in the research laboratory maintained in the city of Washington by the National Varnish Manufacturers Association. This is a bubble viscometer consisting of a series of 20 tubes standardized as to internal diameter and filled

[1] Chief chemist, Valentine & Co., New York City. Paper read before S. A. E. annual meeting.
[2] See S. A. E. Journal, January, 1922, p. 12.
[3] See Automotive Manufacturer, August, 1922, p. 26.

with standardized compounded petroleum oils. These oils vary in color and in viscosity; and each tube, marked A, B, C, D, and the like, contains an oil ½ bubble more heavily bodied than the preceding, and a shade darker in color. In 10-tube sets the variation between one tube and the next is one full bubble, which provides close enough gradation in both viscosity and color for the automotive laboratory. It takes a difference of more than one full bubble before the difference in viscosity will become noticeable under shop conditions. Each viscometer is provided with several extra standardized tubes in which are placed the varnishes to be tested.

The color determination should be made by placing the tube filled with the varnish and the different tubes of the viscometer, one at a time, close together, and looking through them by transmitted light, preferably daylight. If the color of the varnish matches the tube D, or is between C and D, its color can be recorded as "D" or "C-D." Other things being equal, the paler a varnish is the better it is, especially when the preservation of the purity of tone of light or brilliant colors is desired. It is convenient to use these same standard tubes of the Gardner-Holdt viscometer, which in color cover the range of clear automobile varnishes, for reading the color of a given varnish.

The viscosity is determined by holding the tube containing the varnish and one of the tubes of the viscometer exactly parallel in a vertical position and then rapidly reversing the tubes. When the tube of the set is found in which the rate of travel of the bubble is exactly the same as in the tube of varnish, the viscosity of the varnish is read as, say, F-1.40 poises, the poises, or measure of absolute viscosity having been determined for the different tubes of the viscometer. This test should be made carefully to avoid any differences of temperature in the tube of varnish or oil and the temperature preferably should not vary more than 1 deg. above or below 77 deg. F.

As different methods of application and varying shop conditions and temperatures demand varnishes of different viscosities, the method and the apparatus outlined above are the best and most practical that have been devised.

The statement that some shop qualities can best be tested in the shop itself should be qualified by saying that if the tests are so made they should be under adequate technical supervision and carefully checked by the engineering department to assure standardized conditions and authentic records. The subject of service qualities falls almost entirely within the laboratory.

Service Qualities

By service qualities are meant the qualities that determine the ability of a varnish to give service, that is, to stand up under the numerous varying conditions of automobile use. Before deciding what these qualities are it is necessary to understand the causes of the final breakdown that comes eventually to all varnishes. The most important is the chemical action of the sun's rays, that is, the actinic rays of sunlight. These slowly break down the vegetable compounds in the dried film of varnish and promote progressive oxidation or "rotting," thereby causing a gradual loss of elasticity. When the elasticity of the film is reduced below that which is necessary to withstand the expansion and contraction of the surface underneath, and the vibration, small cracks appear and the final break-down approaches.

The importance of the chemical rays in sunlight, as the prime factor in the destruction of finishing varnish, is evident when one observes the perishing of decks and cowls long before the more nearly vertical panels of the body. The surface that gets the sun's rays most nearly perpendicularly will perish first; in fact, on test exposure-panels, a panel exposed at an angle of 45 deg. from the vertical facing south will perish in about one-half the time of an exactly similar panel exposed vertically, and a panel exposed vertically facing north will last approximately twice as long as the one exposed vertically facing south. The effect of the angle of exposure is not always understood, as is shown by the fact that the hoods of automobiles are frequently finished with a varnish less durable than that used on the bodies.

On the top panels of most hoods the angle is about the worst possible, the expansion and contraction owing to changes of temperature being more severe and the vibration very much worse than anywhere else on the car.

A factor contributing largely to this gradual breakdown is moisture or moisture plus alkali, in the form of soap or of mud. The presence of moisture in the varnish-film aids the chemical action of the sun's rays in the final breakdown of the varnish. The destructive action of alkalis such as mud and soap in connection with varnish is, of course, well known. Abrasion also is a contributing cause of the perishing of the coat of finishing-varnish, for the scratches in the surface caused by careless washing or the use of dry washes or polishes when dust or dried mud is on the car, develop eventually into cracks.

To sum up the causes of the deterioration and eventual destruction of the finishing-varnish, we have, first and most important, the chemical action of sunlight, aided by moisture, alkalis, expansion and contraction, vibration and abrasion.

It is clear that to postpone this final break-down a varnish should possess as great an initial elasticity, as high a resistance to the destructive chemical effect of moisture and as thick a dried film as are permitted by the method of application and the time-schedule.

Estimation of Service Qualities

After the automotive engineer has decided on the type of finishing-varnish he wishes to use, he should have the means at his disposal first of finding and then for check-testing the deliveries of the material selected. A lack of such laboratory means would spell chaos if it extended over the whole list of automotive materials, yet many otherwise well organized plants lack the laboratory means for testing and estimating varnish.

The varnish industry as a whole is perhaps as responsible for this lack as is the automotive industry, although, as already mentioned, the National Varnish Manufacturers' Association maintains in the city of Washington a research laboratory that is devoted to the production problems involved in varnish manufacture.

The research laboratory of the company that I represent has striven earnestly to perfect and to standardize the methods of estimating the qualities desirable in a varnish; and some of the methods have been adopted by government laboratories and by the laboratories of certain railroad, automotive and industrial units. The three most important factors in estimating the service-giving qualities of varnish are elasticity, moisture-resistance and the film factor.

In beginning the examination of a varnish it is useful to determine certain constants that are used in checking

uniformity or as bases for other tests. The most important is the non-volatile content, as this is used as a starting-point in the test of elasticity and as one of the necessary elements in computing the film factor or the approximate thickness of the dried film. Next, chiefly for checking purposes, is the ash, which, if it does not exceed 1 percent, is not important; the flash-point, which, to assure proper working qualities and low fire-hazard, should not be below 105 deg. F.; and the acid number, which is unimportant except as a checking figure. The proper methods for determining non-volatile content, ash, flash-point and acid number will be found in Appendix 2.

Elasticity

Elasticity is the most important factor in determining the service-durability of a finishing-varnish and, other things being equal, the comparative durability of a series of varnishes follows exactly their comparative elasticity. This factor can be estimated in the laboratory by the so-called Kauri reduction test for elasticity. This test was developed by me several years ago after a series of experiments made with a view of perfecting a laboratory method for rapidly and accurately estimating the elasticity factor. It was adopted by the government during the war for airplane use and has since appeared in numerous specifications, replacing the former slow and unsatisfactory panel-exposure test.

The test is based on the fact that, if two varnishes are equal in other respects, their elasticity will vary with the gum-oil ratio; in other words, the higher the fixed oil content in terms of the gum content, the greater will be the elasticity. In making the test various amounts of a standardized gum in solution in redistilled spirits of turpentine are added to the varnish. The varnish is then put through a forced drying process on a standardized tin-plate and the plate thus coated is bent rapidly over a rod of fixed diameter. The amount of gum solution necessary to bring the varnish to the cracking-point under this procedure forms a measure of its elasticity, that is, the greater the amount of gum solution necessary, the higher is the elasticity. The elasticity factor is read and recorded in terms of the percentage of gum solution that it is necessary to add to the varnish to bring it to the cracking point, say, 20, 60 or 120, as the case may be. This test determines only the elasticity factor of the varnish and not the original gum-oil ratio, for the kinds of gum and oil used, the kind and amount of drier and the heat-treatment of the varnish during its manufacture all influence the elasticity factor of the finished product. The fact that it is possible to have two varnishes of the same gum-oil ratio that will differ in elasticity by more than 100 percent shows why it is easier to estimate the quality of a varnish by physical tests than by analyses of the components, even were it possible to make such analyses with accuracy.

The range of percentage of the gum solution that exterior varnishes will stand on the Kauri reduction-test is from 0 to 200, the 0 percent being on the border line between the most elastic of the rubbing-varnishes and the least elastic of the finishing-varnishes, and the 200 percent representing the maximum elasticity of a fixed vegetable-oil varnish that contains no gum whatever. Full directions for determining the elasticity factor of a finishing-varnish are given in Appendix 3.

Resistance to Moisure and Alkalis

Varnish is affected by moisture in two ways, physically and chemically, and by alkalis, for both the gums, or resins, and the vegetable oils used in making it, are saponifiable in varying degree. The degree in which varnish is affected by moisture and alkalis can be varied within very wide limits, by both the composition and the heat-treatment of the varnish during its manufacture. For purposes of comparison, the rate at which different varnishes absorb moisture can be determined with sufficient accuracy by observing the rate at which they turn white or opaque when they are immersed in either hot or cold water. Susceptibility to chemical injury by water can be measured by ascertaining how long they must be subjected to the action of water, either hot or cold, before they become permanently whitened, for permanent whitening indicates a chemical change in the structure of the varnish. Comparative resistance to the destructive action of alkalis can be determined by immersing the varnishes in a standard soap-solution for short periods of time, the action of the alkalis on the gums and oils being indicated by loss of luster and whitening.

It is necessary to make these determinations because they have an important bearing on the service-giving qualities of the varnish. In this connection it should be remembered that resistance to both water and alkalis is of greater importance in the case of a varnish that is to be used on the hood, fenders, wheels and axles than of a varnish that is to be used on the body. In a body varnish a resistance to these two elements as high as can be attained without sacrificing the necessary elasticity and freedom of working and flowing is desirable, and, other things being equal, the body varnish that resists moisture and alkalis most effectually is the best choice. A description of the methods for making tests for resistance to moisture and alkalis is given in Appendix 4.

Film Factors

By the film factor is meant the normal thickness of the dried film. The durability of a finishing-varnish varies almost directly with the thickness of the film, provided, of course, the film is not too thick to harden through properly. In the case of undercoats a thick film is to be avoided, but in the final coat the thicker the better, provided, as said before, it is not too thick to dry and to harden properly. Actual measurements of film thickness involve considerable trouble and are difficult to make accurately. But a sufficiently accurate calculation can be made from data used in the other tests. These data are the viscosity of the varnish, in poises, and the nonvolatile content, in percent. By using the following equation the normal thickness of the dried film can be estimated with surprising accuracy, as has been demonstrated in our laboratory by a large number of check tests.

$$F = \frac{1}{2} (10V + N)$$

where

F = the film factor in microms
N = the percentage of the non-volatile content.
V = the viscosity in poises

For example, a body-finishing varnish having a viscosity of 1.40 poises and a non-volatile content of 64 percent will figure as follows:

$$F = \frac{1}{2} [(10 \times 1.40) + 64]$$
$$= 39$$

A 2-ft. square glass panel finished with a normal coat of this particular varnish and measured with the aid of a powerful microscope gave average readings of exactly 39 microms.

This determination of the film factor completes the

data on which the service durability of the varnish is to be estimated; next comes the assembling and the intelligent appraising of the data. Perhaps the easiest way to explain the methods used is to take four finishing-varnishes, A, B, C and D, which are in use in quantity production and on which the elasticity, the moisture resistance and the film factor have been determined, and to rate them according to their estimated service durability. By "durability" is meant the ultimate protection afforded the paint structure on an automobile body under actual service conditions, and not the first signs of checking or cracking looked for on a laboratory exposure panel. The four varnishes selected represent, approximately, the minimum and the maximum limits in color, viscosity, non-volatile content, film factor, moisture resistance, elasticity and service durability of the varnishes in current use for finishing automobile bodies.

The successful comparative rating of varnishes on these data requires careful consideration coupled with experience in varnish testing and research. This is especially true of the resistance to moisture and alkalis. If, however, on the basis of the water and alkali tests outlined above and detailed in Appendix 4, the varnishes are given moisture resistance factors, a reasonable rating will result for average service conditions. A varnish that stands these tests poorly will receive a 0 rating; fair, 10; good, 20; and very good, 50.

To determine the comparative service-durability ratings of the four varnishes, we add together the figures obtained for each in our tests for elasticity, moisture resistance and film factor. This gives the results presented in Table 1.

Table 1. Service Durability Ratings of Four Finishing-Varnishes

Finishing varnishes	A	B	C	D
Elasticity factor	10	60	90	160
Moisture resistance	0	10	20	50
Film factor	35	47	52	36
Service durability rating	45	117	162	246

The film factors for these different varnishes were arrived at by calculation in the formula given above and were based on the data contained in Table 2.

Table 2. Data on Which the Film-Factor Values in Table 1 Were Based

Finishing-Varnishes	Viscosity, Poises	Non-Volatile Content, Percent
A	1.25	58.75
B	3.20	63.75
C	3.20	73.00
D	1.65	56.00

Based on the above rating, varnish B would have a service durability approximately 150 percent greater than that of varnish A; varnish C would exceed the service durability of A by about 260 percent and of B by about 40 percent; and varnish C would show a service durability that is more than 400 percent greater than that of A, more than 100 percent greater than that of B and approximately 50 percent greater than that of C. Expressed in length of life under service conditions, presupposing that the undercoats had been properly applied and that the finish of the car had received intelligent care, varnish A would give about 4 months of service, varnish B would last about 1 year, varnish C would survive almost 1½ years of service and varnish D would last 2 years, before needing renewal.

The fact that varnishes vary in durability by as much as 500 percent may prove surprising. The facts, methods and conclusions I have presented form an outline that the automotive engineer can expand or condense according to his needs.

The information given and the suggestions made may be completely and concisely put into three words: Know Your Varnish!

Appendix 1

Drying and Safety of Working Tests—To test the drying and hardening of the varnish in the laboratory the following standard method will be found satisfactory: Pour the varnish to be tested on a bright tin-panel, 3 x 5 in. in size, that has been carefully cleaned with benzol, and stand the panel in a nearly vertical position in a well ventilated room kept at the same temperature as the shop in which the varnish is to be used, say 70 to 80 deg. F. The panel must not be placed in the direct rays of the sun. From time to time test the film by touching it lightly with the finger at points not less than 1 in. from the edges of the film. The varnish is considered to have dried to touch when gentle pressure shows a tacky condition but no varnish adheres to the finger. The varnish is considered to have dried hard when the pressure that can be exerted between thumb and finger does not move the film or leave a permanent mark after the spot has been lightly polished.

An over-sensitiveness to adverse shop conditions can be determined by the following simple test: Pour an excess of the varnish on a small 3 x 5 in. tin-panel that has been carefully cleaned with benzol, and immediately place the panel in the direct draft of a small 8 to 10-in. electric fan, running at full speed. The panel should be placed in a nearly vertical position, approximately 2 ft. from the fan and at an angle of 45 deg. to the line of the air-current. Allow the panel to remain in this position 5 hr.; remove and allow the varnish to harden overnight. The varnish should show no dulling, enameling, crowfooting or frosting. This test should be made under shop conditions that are normal as to ventilation and temperature.

Appendix 2

Laboratory Determinations, Non-Volatile Content — Place a portion of the sample in a stoppered bottle or a weighing pipette. Weigh the container and the sample. Transfer about 1.5 grams of the sample to a weighed flat-bottomed metal dish about 8 cm. in diameter, a friction-top can plug. Weigh the container again and by the difference calculate the exact weight of the portion of the sample transferred to the weighed dish. Heat the dish and contents in an oven maintained at 105 to 110 deg. C. (221 to 230 deg. F.) for 3 hr. Cool and weigh. From the weight of the residue left in the dish and the weight of the sample taken, calculate the percentage of non-volatile residue.

Ash—Determine the ash in 10 grams by ignition, in a quartz or porcelain dish, carrying out the determination at a low heat, preferably in the muffle. If a muffle is not available, the thinner should first be driven off on a hot plate or in an air-bath before direct ignition. Particular care must be taken not to over-hasten the procedure during ignition, as a reduction of the lead drier salts would invariably follow.

Flash-Point—The open-cup method may be used, as described in the tentative standard of the American Society for Testing Materials, No. D92-21T, or else the closed-cup method, according to Standard No. D56-21 of the American Society for Testing Materials.

Acid Number—Weigh 10 grams of varnish in a 200-cc. Erlenmeyer flask, add 50 cc. of neutral alcohol, connect with a reflux air-condenser and heat in a steam-bath for one-half hour. Remove from the bath, cool, add phenolphthalein and titrate the free acid with fifth-normal sodium hydroxide. Calculate the acid number, that is, the milligrams of potassium hydroxide to 1 grain of varnish.

Appendix 3

The Kauri Reduction Test. Preparation of the "Run" Kauri.—Arrange a distillation flask, a water-cooled condenser and a tared receiver on a balance. Place in the flask about one-third of its volumetric capacity of clear,

bright hard pieces of Kauri gum, broken to pea-size. Carefully melt and distill, until 25 percent by weight of the gum is collected in the tared receiver. At the end of the distillation, the thermometer in the distillation flask, with the bulb at the line of the discharging-point of the flask, should register about 600 deg. F. Pour the residue into a clean pan and, when cold, break into small pieces.

Preparation of Standard "Run" Kauri Solution.—In a carefully tared beaker place a quantity of the small broken pieces of the "run" Kauri with twice its weight of freshly redistilled spirits of turpentine, using only the portion that distills over between 308 and 338 deg. F. Dissolve by heating to a temperature of about 300 deg. F. and bring back to correct weight when cold by the addition of the amount of redistilled spirits of turpentine necessary to replace the loss by evaporation during the dissolving of the gum.

Reduction of the Varnish.—First, carefully determine the non-volatile content of the varnish under test according to the method outlined in Appendix 2. Then take 100 grams of the varnish and add to it an amount of the standard run Kauri solution equivalent to 50 percent by weight of the non-volatile matter in the varnish. Mix the varnish and the solution thoroughly. For the sake of simplicity the amount of varnish to be used is given as 100 grams, whereas 25 grams is sufficient, and taking the smaller amount will conserve the supply both of the sample and of the standard run Kauri solution.

Flow.—Place a coat of the varnish thus reduced on a standard 3 x 5 in. tinned panel, carefully cleaned with benzol, and allow it to dry in a nearly vertical position at room temperature for 1 hr. Next place the panel in a horizontal position in a properly ventilated oven and bake it for 5 hr. at from 96 to 100 deg. C. (205 to 212 deg. F.) Remove the panel and allow it to cool at room temperature, preferably 75 deg. F., for 1 hr.

Elasticity Test.—Place the panel with the varnish side uppermost over a 2-mm. (1/8-in.) rod, held firmly by suitable supports at a point equally distant from the top and the bottom edges of the panel, and bend the panel double rapidly. The varnish should show no cracking at the point of bending. For accurate results the bending of the panel should always be done at 75 deg. F., for lowering the temperature will decrease the percentage of reduction that the varnish will stand without cracking; while raising the temperature will increase the reduction.

If the varnish, when tested as outlined in the preceding paragraph, cracks with the 50-percent reduction specified, make up additional samples reduced with lesser amounts of the standard Kauri solution until a point is reached where it does not crack. If, on the other hand, the varnish does not crack when reduced 50 percent, prepare other samples reduced with larger amounts of the standard Kauri solution, until the cracking-point on subsequent baking and bending is determined.

The panels required for this test are of bright tin, 3 x 5 in., and approximately 0.278 to 0.297 mm. (0.0109 to 0.0117 in.) thick. The weight of the metal per standard base box, 112 sheets 14 x 20 in., Nos. 31 and 30½, United States standard plate gage, is 90 to 100 lb. They should be thoroughly cleaned with benzol immediately before using.

This test, carefully followed out, will enable the varnish testing laboratory to rate the comparative elasticity of a number of unknown varnishes within 2 working days and with greater accuracy than is possible by the panel weather-exposure test, which requires several months. It can also be used for checking the elasticity of deliveries against previous standards. As the elasticity of a varnish is the chief factor in determining its durability the value of this test in, both time saving and accuracy, over that of former methods is very great.

Appendix 4

Moisture and Alkali-Resistance Tests.—For determining the moisture and alkali resistance of a varnish the following method will be found simple and efficient. For the tests use bright tin-panels, 3 x 5 in., carefully cleaned with benzol before using. The same panels specified for the Kauri reduction test may be used.

Pour the varnish on three of the panels, place them in a well ventilated room at shop temperature, preferably from 70 to 80 deg. F., out of direct sunlight, and allow them to dry for 48 hr. Place one of the panels in a beaker containing about 2½ in. of distilled water, immersing the end that was uppermost during the drying period, and leave it in the water at room temperature for 18 hr. Remove it and allow it to dry at room temperature for 2 hr. At the end of this period the varnish should show no permanent whitening and not more than a slight dulling. Place the second panel in a beaker containing about 2½ in. of boiling distilled water, immersing the end that was uppermost during the drying period, and allow it to remain in the boiling water for 15 min. Remove it and allow it to dry at room temperature for 2 hr. At the end of this period the varnish should show no permanent whitening and not more than a slight dulling. If the finishing-varnish does not pass these tests it can be rated as poor on moisture-resistance. In getting the comparative moisture-resistance of a number of varnishes it may be necessary to repeat the tests one or more times. An automobile finishing-varnish need not have the high moisture-resistance demanded in a spar-varnish, but, other features being equal, the finishing-varnish showing the highest degree of moisture-resistance will remain bright and afford protection for the longest time under the conditions of automobile use.

The third panel mentioned above may be used for testing the resistance to alkalis; in this test a standard soap-solution consisting of ½ oz. of Ivory soap dissolved in 1 gal. of distilled water is used. Place the panel in a beaker containing about 2½ in. of the standard soap-solution heated to and maintained at a temperature of 120 deg. F. Leave the panel in the hot solution 10 min., remove it and immediately rinse it thoroughly in clear cold tap water, and allow it to dry at room temperature for 1 hr. At the end of this period the varnish should show no whitening and not more than a slight dulling. A finishing-varnish failing to pass this test should be rated poor on alkali-resistance. In getting the comparative resistance to alkali of a number of varnishes this test may be repeated one or more times, using fresh soap-solution each time. While all oil-varnishes will finally be destroyed by the action of alkali, other features being equal, the finishing-varnish showing the highest degree of resistance to its action will remain bright and afford protection for the longest time under the conditions of automobile use.

A higher resistance to the action of moisture and alkali should be required to a finishing-varnish for use on hoods, fenders, wheels and underparts than is required for body use.

1923 Hand Book of Automobiles

Two hundred and twenty-nine models of motor cars are illustrated in the 1923 Hand Book of Automobiles which has just been issued by the N. A. C. C., 366 Madison avenue, New York. The total number of car models and truck chassis listed is 834.

The book is a ready guide to the general appearance, price and specifications of the principal models of automobiles and motor trucks being produced this year by the leading manufacturers in the United States who are members of the N. A. C. C. The gasoline passenger car section illustrates 154 models with 69 in the gasoline commercial division and 6 in the electric vehicle division. The total passenger car models listed is 572. In the commercial division 251 chassis types are listed, with various body equipment, while the electrics include eight passenger cars and three trucks.

This Hand Book of the automobile industry in America has become a standard of reference among domestic and foreign dealers, export houses, American consuls, state secretaries, dealer associations and clubs. Copies may be obtained from the N. A. C. C. which makes a charge of 50c each, to partially cover cost.

Facts and Figures of the Automobile Industry for 1922

By ALFRED REEVES

General Manager, National Automobile Chamber of Commerce

Production

Cars and trucks	2,527,000
Trucks	240,000
Cars	2,287,000
Previous record motor vehicle production (1920)	2,205,000
Number of new cars needed for replacements in 1923	1,800,000
Production of closed cars	35%
Total wholesale value of cars and trucks	$1.558,567,000
Total wholesale value of cars	$1,374,487,000
Total wholesale value of trucks	$184,080,000
Estimated average retail price of car 1921	$900
Estimated average retail price of car 1922	$770
Reduction in average retail price of car	14%
Estimated average retail price of truck 1921	$1,326
Estimated average retail price of truck 1922	$1,050
Reduction in average retail price of truck	21%
Tire production	36,340,000
Number of persons employed in motor vehicle and allied lines	2,431,400

Registration

Motor vehicles registered in U. S. (approximate)	11,500,000
Motor cars	10,250,000
Motor trucks	1,250,000
Increase in U. S. registration over last year	7%
World registration of motor vehicles	12,750,000
Percent of world registration owned by U. S. A.	81%
Motor vehicle registration on farms	3,500,000
Motor cars	3,300,000
Motor trucks	200,000
Motor cars serving suburban communities	780,000
Passengers carried annually by motor car	7,500,000,000

Automobile's Relation to Other Business

Number of carloads of automobile freight shipped by railroad	400,000
Percent of rubber supply used by automobile industry	83%
Percent of plate glass supply used by automobile industry	30%
Percent of aluminum supply used by automobile industry	20%
Percent of iron and steel supply used by automobile industry	4%
Number of doctors using motor cars	110,000
Number of motor cars owned by corporations	600,000
Gasoline consumption (U. S.) 1922 (gallons)	5.300,000,000
Average monthly surplus of gasoline (gallons)	784,261,000
Gasoline consumption (U. S.) 1921 (gallons)	4.506.706,000
Percent of cars used more or less for business	90%
Percent of total car mileage used entirely for business	60%

Exports

Value of motor vehicles and parts exported (including engines and tires)	$123,742,000
Number of motor cars exported	66,000
Number of motor trucks exported	10,000
Value of motor cars exported	$52,125,000
Value of motor trucks exported	$8,381,000

Motor Vehicle Retail Business in U. S.

Passenger car dealers	38,000
Motor truck dealers	25,000
Public garages	48,000
Service stations and repair shops	63,000
Supply stores	63,700

Resale Value

The determining factor in the automobile business is based upon the word "service" and is exemplified in resale value. The thing that will determine ultimate production is not the original list-price but the second-hand price. There are 88 member companies in the National Automobile Chamber of Commerce. Twelve of them build about 87 percent of the cars the 88 companies produce. Not all of the products of those 12 have a high second-hand value. I asked about 500 leading distributors to tell me the second-hand value of the last three models of the 30 leading producers in the industry. I found that they maintain a list of 12 to 15 automobiles which they consider to be of sufficiently high second-hand value to take them in with the hope of a profit in the second sale.

The dealer is handling about 80 percent of his business on a time basis. Every time he sells an automobile, he takes in one, two or three other automobiles. He discovers very quickly that there is only one chance for him to stay in the business as a dealer, and that is to find out what cars have sufficient value to enable him to sell them a second time at a profit.

A man who starts in business to do one thing consistently day after day and year after year, and sticks to it, not influenced by this or that dealer or sales manager, or this or that new idea, is likely to dominate his field, because he develops the economic situation from the standpoints of manufacture, distribution and service. The only way to undersell another man is to build a better car.—E. S. Jordan, before the Detroit Section of the Society.

Russia Has Automobile Plant

Soviet Russian government has turned automobile maker. The first car to come to Riga is described as of 45 horsepower, and weighs 2,530 pounds. It has a speed of 53 miles an hour and seats seven passengers. Operation of the factory where the first car was produced is said to be in the hands of a staff trained in this country.

French Test of Producer-Gas Trucks

First prize in the French gas-producer trials has been won by the British entrant, the Thornycroft suction gas vehicle. The six competing trucks used four-cylinder engines designed to run on gasoline. Four of the trucks employed charcoal as fuel; the other two, a mixture of one-fifth charcoal and four-fifths wood.

The competition showed that with an engine designed for gasoline, there was a loss of power when gas was substituted. Taking the power of the gasoline engine as 1, with producer gas the power would drop to between 0.50 and 0.73 if the engine were not altered in any way, and to between 0.70 and 0.90 if changes were made in the compression, size of valves or areas of valve-openings and gas passages. It has been considered that the results of the trials show that there is an economy of 25 percent in the use of gas compared with gasoline.

The Thornycroft powerplant differs essentially from others on the market in one or two features. The steam is produced in a separate generator, which is not attached to the producer, by heat from the engine exhaust on the principle that the heat of the exhaust gases must necessarily be proportionate to the powers developed, and thus the amount of steam can be made proportionate to the working. This generator can be detached from the engine and entirely taken to pieces for cleaning, which is a point of very great importance. The Thornycroft powerplant is intended primarily for use with the chassis of the British war office pattern, known as the J type, and is designed as an integral part of the machine. Consequently, every part is easily accessible, in no way interfering with the fitting of an ordinary cab or body and detracting but little from the appearance of the vehicle. Moreover, the weight can be cut down to a minimum.

Generally speaking, the engine can be started on gas in less than 10 min. from cold, after which it is said that the car can be left standing for an indefinite period, the engine idling, with a certainty of starting away as soon as the throttle is opened, whatever the load.

No water is used for the cleaning or scrubbing of the gases, and cleaning is thereby much simplified, while the possibility of any corrosion or electrolytic action taking place is eliminated.

U. S. Exporters Should Send Separate Invoices With British Consignments

American exporters shipping goods to Great Britain are urged to send either a packing slip or a separate invoice giving the necessary details, with each separate case. This is particularly important in the case of automobile parts which are liable in many cases to import duty, and have to be examined carefully by the customs, and more so when a shipment is packed in several separate cases. As an example, the instance of a consignment of gears might be quoted, in which all the shafts are packed for convenience in one case and the gearboxes in another.

It has happened recently that considerable expense and delay have been incurred on this side due to the failure of the exporter to send some such document as mentioned above. The British Customs authorities have held up goods and even demanded that a packing note be secured from America. The inconvenience and additional charges of all kind involved can readily be imagined.

The matter may seem only a detail, but a collection of such difficulties tends to discourage trade between individuals on different sides of the water, and it is the chamber's sincere desire to smooth away any such barriers in the way of the friendly commercial relations of the two countries.

It is hoped that importers will do their part by insisting upon the inclusion of a packing slip, or, as stated above, an invoice covering each case of goods, with all shipments consigned to themselves, and that manufacturers in the United States will endeavor to cooperate to the fullest extent in this matter.

Body Equipment Market in Australia

The manufacture of motor vehicle bodies has become an important industry in South Australia during recent years. In the early days of the trade motor vehicles were imported with bodies; but of the 15,000 cars and trucks sold annually in Australia at the present time, probably less than one-tenth are imported complete. Purely Australia timbers, such as mountain ash, Tasmanian oak, Queensland kauri, myrtle, and yellowwood, are used. The metals, trimmings, and other material required in the manufacture of bodies are imported chiefly from the United States and Great Britain.

The largest motor-body factory in Australia is located at Adelaide, where 750 men are employed. The firm was organized in 1918 with a paid-up capital of £130,000. Branches are located at Sydney, where 50 men are employed, and at Melbourne with 90 men. The factory produces about 9,000 bodies per year for all classes of motor vehicles, or about 60 percent of the total number manufactured in Australia. The agencies of a low priced American car also produce most of the bodies necessary for their imported chassis, the Australian firm mentioned above building the remainder.

American manufacturers of motor body equipment who desire to extend the Australian market for their products (such as bow sockets, top and body irons, stampings, trimmings, curtains, special forgings, etc.) may secure the names of the firms engaged in motor body building in Australia by applying to the Automotive Division through the proper district or cooperative office of the Bureau of Foreign and Domestic Commerce, requesting trade list FE—23042.

Finds Europe Slow in Body Building

E. W. Goodwin, consulting engineer of the Maxwell Motor Corp., body division, recently returning from Europe, declared that large scale body building in Europe must await the awakening of manufacturers there to modern business methods. He found the demand for closed cars not advancing in France very rapidly although in England there is an increase but mostly for the landaulet type.

Goodwin, studying carefully the work of coach builders in Europe, both past and present, learned that although there have been great improvements in methods of manufacture, there has been little change in fundamental principles. Examining an elaborate, gold-plated coach of the time of Napoleon now in the Palace of the Kings at Versailles, he found that the framework differed but very slightly from that employed in building modern closed automobile types.

Manufacture of Automobile Bodies and Parts, 1921

The Department of Commerce announces that according to reports made to the Bureau of the Census the value of products of establishments manufacturing chiefly automobile bodies and parts amounted to $407,917,000 in 1921, as compared with $692,171,000 in 1919, and $129,601,000 in 1914, a decrease of 41.1 percent from 1919 to 1921, but an increase of 214.7 percent for the seven-year period 1914 to 1921. The term "bodies and parts" signifies chassis, bodies, tops, radiators, steering wheels and gears, carbureters, axles, wheels, bearings, hoods, mufflers, fenders, etc. This classification, however, does not include rubber tires, engines, motors, springs, lamps, and starting and lighting systems, the manufacture of which by establishments other than those producing complete automobiles is shown under different industry classifications as "engines," "electrical apparatus, machinery and supplies," "rubber tires and tubes," "lamps and reflectors," "steel springs for cars, carriages, etc."

The 1,974 establishments in this industry reporting products valued at $5,000 and over in 1921 were located in 45 states and the District of Columbia. Michigan was the leading state in value of products reporting $176,791,000; Ohio was second, with $46,341,000, followed by New York, Indiana, Pennsylvania, and Illinois.

There was considerable fluctuation in the number of wage earners employed each month. In May, the month of maximum employment, 79,363 wage earners were reported, and in January, the month of minimum employment, 45,158—the minimum representing 56.9 percent of the maximum.

The statistics for 1921, 1919 and 1914 are summarized in the following statement; the figures for 1921 are preliminary and subject to such change and correction as may be found necessary from a further examination of the original reports.

	1921[1]	1919[1]	1914[1]
No. of establishments	1,974	2,123	764
Persons engaged	79,607	153,182	53,954
Proprietors and firm members	1,515	2,129	700
Salaried employees	8,973	18,497	5,469
Wage earners (aver. number)	69,119	132,556	47,785
Salaries and wages	$125,952,000	$213,924,000	$54,553,000
Salaries	29,173,000	34,968,000	19,560,000
Wages	96,779,000	178,956,000	34,993,000
Paid for contract work	984,000	1,560,000	186,000
Cost of materials	213,965,000	362,027,000	63,610,000
Value of products	407,917,000	692,171,000	129,601,000
Value added by manufacture[2]	193,952,000	330,144,000	65,991,000

[1] Statistics for establishments with products valued at less than $5,000 are not included in the figures for 1921; there were 423 establishments of this class, reporting 3,907 wage earners and products valued at $1,165,900. For 1919, however, data for 392 establishments of this class, reporting 233 wage earners and products valued at $1,101,800, and for 1914, data for 207 such establishments, with 244 wage earners and products to the value of $582,700, are included in the figures with the exception of the item "number of establishments."

[2] Value of products less cost of materials.

Chevrolet Makes Record Shipment

Chevrolet Motor Co. shipped from its various assembly plants in the United States 2,158 complete automobiles on Jan. 20. This is a record day's shipment for the concern.

Annual Meeting of Automotive Engineers

During the annual meeting of the Automotive Engineers held in New York City, Jan. 9 to 12, papers were presented covering many phases of automotive engineering. At the standards committee meeting many important reports were presented with regard to which action for adoption, revision, or rejection was taken. These reports had previously been published in the journal of the society, so that the members attending the meeting were able to offer carefully thought out suggestions or criticisms. An aeronautic session was held at which several well-known authorities on commercial aircraft presented brief statements on certain fundamental design problems, the solution of which is considered necessary before commercial aviation can progress further.

Professor G. A. Young presented a paper on "Practical Methods of Securing High Compression Without Detonation." This paper brought out some interesting results of research work conducted in the laboratory of Purdue University. Thomas Midgley, jr., read a paper on "Fundamental Laws Governing Detonation," and Stanwood W. Sparrow and S. M. Lee of the Bureau of Standards presented a paper on "Means of Measuring Detonation and Comparing Fuels for Use in High-compression Engines." Robert E. Wilson presented a paper on "The Function of Oil and Fuel in Crankcase Dilution," and C. S. Kegerreis read a paper on "Carburetion of Gasoline and Kerosene."

One entire session was devoted to reports and discussions of the progress made in the fuel research project that was formulated by the research department of the society. Two sessions dealing with air-cooled engines were also held, and the body engineering session offered papers of interest to engineers engaged in this phase of automobile building.

Rutherford Heads M. & A. M. A.

W. O. Rutherford, vice president of the Goodrich Co. was elected president of the Motor and Accessory Manufacturers' Association, at the annual meeting of the board of directors held in New York early in January. A few days later he was accorded an additional distinction of being elected to the vice presidency of the Rubber Association of America. The double honor comes to Mr. Rutherford as a result of his untiring energy in furthering the aims of the two associations.

The Motor and Accessory Manufacturers' Association is one of the oldest and the most important of any in the automotive accessory and parts industry. It was organized in 1904, and its membership includes the executives of all leading manufacturers of parts and equipment. Its work has been constantly developing in importance and scope until today it stands as one of the important factors in cooperative advancement of the automotive industry. Mr. Rutherford was first vice president and chairman of the foreign trade committee of this association last year. He has always been prominently identified with the organization's work and has done much to make the association's work more influential.

The Rubber Manufacturers' Association is composed of all rubber manufacturers engaged in the manufacture of rubber goods of every description throughout the country, and has been a strong factor in the betterment of the rubber industry.

Detroit's Demand for Cars Exceeds Supply

Detroit is in the midst of a wave of prosperity that has necessitated war-time methods to untagle the unprecedented congestion in railroad yards and terminals, says Iron Age. The Detroit operating committee, consisting of W. D. Trump, general manager of the Detroit Terminal railroad; H. O. Halstead, superintendent of transportation of the Pere Marquette railroad, and S. W. Brown, assistant to the general manager of the Michigan Central railroad, has been placed in charge of the situation. The threatened general embargo has been averted although the freight congestion is only slightly improved. Approximately 15,000 freight cars, including 1,000 cars of bituminous coal, are lying idle on the side-tracks and at terminals waiting to be unloaded. Industrial plants, some of which have as high as 50 cars in the Detroit district, have been advised that further shipments will be stopped until they clear up the consignments now on hand. With embargoes already placed on 15 commodities, Mr. Trump said today that the fuel situation would not be aggravated.

In many instances the railroads have cancelled demurrage charges as a special inducement to get cars unloaded. All factories are working over-time and many of them with night shifts, so that the railroads have been swamped with deliveries of raw materials. Estimates have been made showing that the railroads in the Detroit district have carried more freight in the last 30 days than ever before in their history.

Testing Oils as Usable Fuels

The research laboratories of Carnegie Institute of Technology, Pittsburgh, in its department of chemical engineering, has been conducting a series of tests to determine the relative merits of various oils as usable fuels.

According to a report by Dr. J. H. James, head of the department conducting the experiments, oxidized kerosenes cause less "knocking" tendencies than straight kerosene when used in a kerosene engine. The tests also showed that ozidized kerosenes have approximately the same power development as ordinary kerosene, in spite of the fact that their thermal value is one-eighth less. Dr. James attributes the efficiency of the oxidized kerosenes to the better "clean up" in the combustion of these partially oxidized fuels.

The success of the experimental work at Carnegie at this stage gives promise that oxidized kerosene, which is manufactured by catalytic oxidation from low grade petroleum, may become a useful fuel in the future. Its properties may cause it to be used industrially in kerosene engines or blended with gasoline for use in gasoline engines Although it has a somewhat lower fuel value than ordinary kerosene, one of the most favorable features of its effectiveness is that it undergoes much better combustion in the internal combustion engine.

Automobile Numbering Device

A drilling device to be used in a new method of "branding" automobiles and trucks, something after the manner in which ranch animals are branded in the west has been developed by a New York engineer, Jack Marshall, of 509 Fifth avenue, New York city. The Marshall automobile-numbering device is a drilling machine which automatically drills any given number, letter, or symbol, or any manufacturers' or license number into the body, motor, or any other part of the car, thereby making it impossible for automobile thieves and dealers in stolen cars to change the numbers. The numbering machine is operated by electricity, and the number is large enough so that it can easily be seen.

Fatigue of Metals

In a paper on the Fatigue of Metals recently presented to the Royal Aeronautical Society, Prof. C. F. Jenkins, a member of the Fatigue Panel of the Aeronautical Research Board, cautioned engine builders against running a new engine on a full power test until the fatigue limit of the highly stressed parts had been raised by making a series of short runs at gradually increasing load up to the maximum the engine would carry. That this has the effect of increasing the fatigue limit was shown by Gough and Lee on test pieces.

Marine engineers never start up a ship's engine at full load, but bring it up to this point gradually. One reason for this may be to give the bearings time to run in, but the experiments described in his paper, Prof. Jenkin said, suggested that it might also be most valuable to give the molecules of the steel time "to slip into their central position," and for the sheared faces of the crystals to heal. A proper start might add 20 percent to the engine's strength.

Foreign Trade Convention, May 2-4

The dates on which the Tenth National Foreign Trade Convention will meet in New Orleans have been postponed to May 2, 3, 4, 1923, according to announcement of O. K. Davis, secretary of the National Foreign Trade Council.

The convention will devote special attention to the European situation, the part played by imports in our national life, and transportation by rail and water. Group sessions will deal with the practical details of export sales management, finance, credits, and advertising, with particular consideration of problems affecting the Gulf Coast and the Pacific.

Auto Industry in 1922 Exceeded All Records

All past records in automobile production were surpassed in 1922. At present, the automobile industry continues to produce in excess of any previous figures for this time of the year, and some of the leading companies are operating nearly at capacity, which ordinarily happens only during the late spring and early summer months. The manufacturers are confronted with transportation, raw material, and labor problems, but so far there has been no noticeable decline in factory operations in this account.

Decree on Factory Numbers

All imports of automobile chassis and engines, under a decree of the Spanish government, must have the factory numbers either engraved or cast on the chassis and engine.

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

Charles C. McElwain, treasurer of Kibbe Bros. & Co., and director of the Safe Deposit & Trust Co., of Springfield, Mass., has been named chairman of the board of directors of the new Springfield Body Corp., which has been formed as an alliance of custom body makers who expect to turn out 15,000 of such jobs yearly. **M. A. Kammer,** a well known custom body builder, with 25 years' experience in this field, is in charge of the manufacturing division. **B. O. Provins,** formerly with Rolls-Royce, is assistant to President Dame. **J. W. Sarle,** also late of Rolls-Royce, is works manager at the Springfield plant, and R. J. Schuler, recently with the Detroit Gear & Machine Co., is Detroit representative.

Pierre S. du Pont, Irenee du Pont, Lammot du Pont, John J. Raskob, Alfred P. Sloan, jr., J. Amory Haskell and C. S. Mott have resigned as directors of the Fisher Body Corp., thus making it unnecessary for these men to act in a dual capacity as directors of both General Motors and Fisher Body. The personnel of the board of directors as now constituted, is as follows: **Fred J. Fisher,** president; **Charles T. Fisher,** vice president; **Louis Mendelssohn,** chairman of the board and treasurer; **Aaron Mendelssohn,** secretary; **William Butler,** comptroller; **William A. Fischer, Lawrence P. Fisher, Edward F. Fisher and Alfred J. Fisher, directors.**

Roy D. Chapin, who has been president of the Hudson Motor Car Co., has been elected to the chairmanship of the board of directors. He is succeeded by **Roscoe B. Jackson,** whose title is now president and general manager, he having been vice president, treasurer and general manager. **William J. McAneeny,** formerly secretary, was made vice president and treasurer. **Howard E. Coffin** and **O. H. McCornack** were reelected as vice presidents, and **A. Barit** was named secretary.

Clarence F. Tollzien, for many years associated with the Packord Motor Car Co., of which he was at one time purchasing manager and later production manager, has joined the Spring-Perch Co., Stratford, Conn. Tollzien will act as general representative of that organization for the states of Ohio and Michigan. He will have offices in the General Motors building, Detroit.

William E. Holler, former managing director of the Flint Chamber of Commerce, has resigned to join the staff of W. C. Durant. He is now assistant to the motor car manufacturer. Holler was lately general manager of the Imperial Wheel Co., now a part of the Hayes Wheel organization. His new offices will be in Long Island City.

Henry T. Chandler has become associated with the Vanadium Corporation of America as metallurgical engineer with headquarters in Detroit. Mr. Chandler was formerly associated with C. Harold Wills in C. H. Wills & Co. as metallurgical engineer, and before that was research engineer for the Ford Motor Co.

H. H. Franklin, president of the H. H. Franklin Mfg. Co., reached New York just in time to be in at the close of the automobile show in New York. Franklin reports that marked improvement has been made abroad within the last year, and he looks for a steadily increasing market for American cars.

Morgan Goetchius, on the staff of J. D. Mooney, vice president in charge of foreign affairs of the General Motors Corp., sailed on Jan. 6 for Europe. He will investigate the possibilities of further development of General Motors' extensive operations in western Europe.

Mortimer E. Cooley, dean of the engineering school of the University of Michigan, has been re-elected president of the American Engineering Council. The council meets at Washington, D. C., and represents more than 30 national and local engineering organizations.

Harold T. Moore has been elected secretary and a director of the Tuthill Spring Co., Chicago. He has been with the concern for many years and lately has been production manager, a position he still retains. He succeeds, as director and secretary, D. S. Campbell.

Lynn McNaughton, general sales manager, has been elected vice president of the Cadillac Motor Car Co., and member of the board of directors. McNaughton will continue, however, to discharge the functions of the general sales managership.

A. B. C. Hardy, president and general manager of the Olds Motor Works, was elected a director of the Capital National bank, Lansing, Mich., recently. R. E. Olds, president of the Reo Motor Car Co., is president of the institution.

Charles W. Nash of Kenosha, Wis., president of Nash Motors Co. and the Lafayette Motors Corp., Milwaukee, was elected a director of the First Wisconsin National Bank of Milwaukee at the annual meeting of stockholders.

R. L. Doyle, who has had more than 12 years' experience with General Motors Truck Co., has joined the factory executive staff. He is attached to the sales department at Pontiac.

H. B. Griffin has again joined the forces of the Doehler Die-Casting Co. He returns as vice president.

Marvin E. Monk has been made director of sales for the U. S. Ball Bearing Mfg. Co., Chicago.

Body Builders

Springfield Body Corp., Springfield, Mass., recently organized to take over and operate the plant of the Smith-Springfield Body Corp., manufacturer of automobile bodies, has completed negotiations with the General Motors Corporation for the purchase of a portion of its works at Bloomfield, N. J., comprising the section known as plant D, totaling about 175,000 sq. ft. Immediate possession will be taken. The company has acquired about 5 acres adjoining the present Springfield works for the erection of an addition to double the capacity of this plant. Negotiations are in progress for the purchase of a plant at Detroit, to develop an annual production of about 10,000 bodies. Clarence S. Dame, formerly president of the Smith-Springfield company, heads the new organization; Arthur H. Wolfe is vice president.

Mengel Body Co., Dumesnil and 11th streets, Louisville, will soon award contract for the second unit of its new plant at Fourth and C streets for the manufacture of automobile bodies, comprising a one-story and basement structure, 150 x 250 ft. Foundations are being completed for the first unit of similar size. The initial plant will cost $400,000, with machinery. A. D. Allen is president.

Treat Place Body Works, Newark, recently organized, has leased property at 41 Treat Place for the establishment of a plant to manufacture automobile bodies. The structure is 30 x 100 ft., and will be equipped at once. Charles D. Shlenoll heads the company.

H. & M. Body Corp. enter the new year with capacity operation, utilizing a force of between 1,500 and 2,000 men. General Manager L. A. McDowell reports that operations due to orders now in sight will keep the factory going full tilt for the next 11 months.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Ford Motor Co. of Canada, Toronto, has awarded contract to Anglin Norcross, Ltd., for the new assembling plant, and it is expected that it will be in operation within six months. The estimated cost of the project, including land and buildings, is $1,000,000. The contract calls for a one-story assembling building, 400 x 500 ft., and powerhouse 50 x 120 ft. It is understood that the company will concentrate the greater part of the assembling of its products marketed in the central Ontario district in the new plant and as demand increases extensions will be made.

Studebaker Corp., South Bend, Ind., is arranging a construction program during 1923, involving about $7,000,000 of a fund of $15,000,000 established for this purpose. It is proposed to construct a number of new buildings for an increase in practically every department, to allow a production of 150,000 complete automobiles during the year, as compared with a gross output of 110,000 machines in 1922. It is expected to have the expansion completed by Jan. 1, 1924, with the employment of 5,000 additional men.

Timken Roller Bearing Service & Sales Co., which began its functions on Jan. 1, completes the program of the Timken Roller Bearing Co., Canton, O., in following its products from the raw material through its steel, rolling and tube mills, located in three foreign countries and the United States, to the final market. The new branch will have entire supervision of sales through the 32 factory branches scattered throughout the country.

R. H. Long Motors Co., Framingham, Mass., has been incorporated under state laws with capital of $1,500,000, to take over and operate the plants of the R. H. Long Co. at Framingham and Worcester, specializing in the production of a six-cylinder car. Arrangements have been perfected for the establishment of a factory branch at 252 Central avenue, Newark, N. J. Richard H. Long is president and treasurer.

Ford Motor Co., which is about to erect a large plant at Hegewisch, Ill., is also completing arrangements to build an assembling unit on the Mississippi river at St. Paul, Minn. The project will involve an ultimate expenditure of $10,000,000. The Ford assembling plant at Minneapolis, it is understood, will be moved to St. Paul. A new assembling unit is also planned for St. Louis.

Wisconsin Truck Co. of Madison, Wis., recently incorporated with $25,000 capital stock, is negotiating for the lease of a suitable factory for assembling motor trucks. For the present only a small list of machinery will be required, as most units and parts will be purchased from specializing concerns. John C. Westmont, C. W. Keniston and O. B. Porter are the principals.

Ford Motor Co., Detroit, has purchased 167 acres on the Mississippi river at St. Paul, Minn., immediately adjacent to the government high dam. Application has been made for power rights at the dam, but if this is denied it will erect a plant to be operated entirely by steam power. If water-power rights are granted, it has planned to build a $10,000,000 manufacturing plant.

M-B Automotive Corp., Nashville, Tenn., has acquired 10 buildings at the former Old Hickory powder plant of the government, and plans the immediate establishment of works to manufacture motor buses, motor-driven fire equipment and other heavy motor cars. The structures will be remodeled and equipped for an initial output of 10 complete machines per day.

General Motors Corp., Detroit, has acquired a controlling interest in the Brown-Lipe-Chapin Co., Syracuse, N. Y., manufacturer of gears and transmission systems, and will operate the plant under its present name as a subsidiary. H. W. Brown, heretofore general manager, has been elected president.

Sheldon Axle & Spring Co., Wilkes-Barre, Pa., plans for the immediate rebuilding of the portion of its No. 1 spring mill, destroyed by fire Jan. 4, with loss estimated at $200,000, including equipment. It is expected to suspend production for about a month.

Dodge Brothers, Inc., has plans in preparation for two additions, comprising a four-story and basement building, 100 x 450 ft., and one-story structure, 85 x 100 ft. The first noted will be used as a parts department, and the other for general operating service.

Ford Motor Co., 7th street and Santa Fe avenue, Los Angeles, will take bids at once for a two-story addition to its assembling plant, 132 x 350 ft. John Parkinson and Donald Parkinson, 420 Title Insurance building, are associated architects.

Liberty Starter Co., 2281 W. Fort street, Detroit, manufacturer of starting and lighting equipment, is said to be planning the erection of a new factory. It recently increased its capital to $1,000,000 for expansion.

Ford Motor Co., Ponce de Leon avenue, Atlanta, Ga., is completing plans for extensions in its assembling plant and will install equipment to increase the production from 150 to 225 completed cars per day.

Waltham Motors Mfg. Co., Inc., Waltham, Mass., formed to make the Waltham car, is selling out its plant, production having ceased some time ago. The factory is handling old Metz car parts.

Chevrolet Motor Co., Flint, Mich., has filed plans for a two-story assembling plant, 90 x 338 ft., and loading platform at East Delavan avenue and the Erie railroad, Buffalo, at a cost of $950,000.

Studebaker Corp., South Bend, Ind., is about to let contracts for a building 700 ft. long and four stories high, to replace the old portion of the plant along the New York Central right-of-way.

Studebaker Corp., South Bend, Ind., is planning the construction of a four-story and basement, reinforced-concrete addition, 120 x 600 ft., to cost $400,000.

Cadillac Motor Car Co., 2860 Clark street, Detroit, has commenced the erection of a one-story building, to cost about $30,000, exclusive of equipment.

Chevrolet Motor Co., Detroit, has tentative plans for the establishment of a branch assembling plant at Memphis, Tenn.

Additional Notes of Body Builders

American Motor Body Co., Dixon, Ill., has been organized to manufacture and deal in automotive or other vehicles and accessories. Capital $50,000. Incorporators: E. F. Johnson, J. E. Ohora, R. D. Netherton.

Detroit Weatherproof Body Co., Corunna, Mich., manufacturer of automobile bodies, has tentative plans for a new two-story and basement factory, 60 x 100 ft., to cost $150,000, including machinery.

Woodward Body Works has been organized at Austin, Tex., with a capital stock of $125,000. Incorporators are Sam Sparks, D. C. Reed and W. T. Caswell.

J. S. Morris Carriage Co.'s works, Waupun, Wis., was destroyed by fire Dec. 20. The loss is said to exceed $75,000.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

4691—Asbestos brake linings, asbestos friction clutch facings, metal and asbestos gaskets, including cylinder-head packings, and radiator cement—Norway. Purchase and agency desired.

4694—Speedometers for automobiles, motor cycles, and bicycles, measuring in kilometers; meters for gas, water, and electricity; clocks and accessories; and automobile accessories, including tires, pistons, and carburetors—Belgium. Agency and consignments desired. Quotations, c.i.f. Antwerp.

4712—Four-cylinder motor cycles—Austria. Agency desired. Quotations, f.o.b. New York.

4714—Automobiles, motor cycles, motors, etc.—Sweden. Agency desired. Quotations, c.i.f. Goteborg.

4743—Automobile accessories such as lighting systems, electric starters, and furnishings for automobile bodies—Austria. Agency desired. Quotations, f.o.b. New York.

4772—Automobile lamps and spot-lights, nickel horns with rubber bulbs, and cord and fabric tires—Uruguay. Purchase and agency desired. Quotations, c.i.f. Uruguayan port. Correspondence, Spanish.

4777—Automobiles—Austria. Agency desired. Quotations, f.o.b. New York. Correspondence, German or French.

4780—Artificial leather, especially for use for automobile trimming, and traveling equipment—Cuba. Purchase and exclusive representation desired. Quotations, f.o.b. New York.

4811—Cold tire setter for wagon wheels, to shrink any size up to 1 by 4 inches, side grip—South Africa. Purchase desired. Quotations, f.o.b. New York.

4837—Small low-priced automobile—Sweden. Purchase and agency desired. Quotations, f.o.b. New York.

4865—Automobiles of medium price and automobile accessories, especially tools, air compressors, tires, self-starters, weed chains, levers, dynamos, and self-igniters; motor truck; and motor cycles—Hungary. Agency desired. Quotations, c.i.f. European port.

4867—Artificial or imitation leather in connection with automobile accessories—Denmark. Purchase and agency desired.

4876—Motor cycles—Austria. Agency desired. Quotations, f.o.b. New York.

4880—Automobiles of medium price and motor wheels of all kinds, including cushion wheels—Austria. Agency desired. Quotations, f.o.b. New York.

4884—Automobiles and accessories—France. Purchase and agency desired. Quotations, c.i.f. Havre or Antwerp.

4885—Light automobiles and motor cycles—Austria. Agency desired. Quotations, f.o.b. New York.

4888—Motor cycles—Austria. Agency desired. Quotations, f.o.b. New York. Correspondence, German or French.

4889—Passenger automobiles of small type and motor cycles of light construction—Austria. Agency desired. Quotations, f.o.b. New York.

4895—Light passenger automobiles—Austria. Agency desired. Quotations, f.o.b. New York. Correspondence, German.

4899—Motor cycles of medium price, equipped with 4 to 5 horsepower engines—Austria. Agency desired. Quotations, f.o.b. New York. Correspondence, German.

4907—Passenger automobiles of first-class manufacture, trucks, and motor cycles—Austria. Agency desired. Quotations, f.o.b. New York.

4915—Automobiles, and accessories, and hardware articles—Sweden. Purchase desired. Quotations, c.i.f. Swedish port. Terms: Payment against documents.

4937—Bicycles, motor cycles, sundries, and boat motors—Finland. Purchase. Quotations, c.i.f. Helsingfors, Hango, or Abo. Terms: Cash against documents.

4956—Standardized automobile parts, such as motors, wheels, radiators, gears, brakes, steering gears, frames, and transmissions—Norway. Purchase.

4969—Machine tools for automobile repair shop, reforming press for iron, and foundry installations for bronze and malleable iron—Greece. Purchase. Quotations, c.i.f. Greek port. Terms: Payment arranged by confirmed letter of credit against documents. Correspondence, French.

4993—Automobiles, agricultural machinery, typewriters, steel rails, calicoes, and novelties—Serbia. Agency. Payment: Cash.

5025—Automobile tires, both clincher and straight side, and for the most part cord—Chile. Purchase or agency. Quotations, c.i.f. Chilean port.

5032—Leather cloth for upholstering purposes and other articles used in the upholstering trade—Norway. Purchase. Quotations, c.i.f. Norwegian port. Payment to be made through bank in New York.

5043—Automobiles, motor cycles, bicycles, and accessories—Sweden. Purchase and agency. Quotations, f.o.b. New York.

5044—Small vulcanizing outfits and automobile accessories—Italy. Purchase or agency. Terms: Cash against documents. Correspondence, Italian.

5078—Tires of the best grade—Austria. Agency. Quotations, f.o.b. New York.

5085—Machinery for repairing and reinforcing automobile tires—Spain. Purchase. Quotations, f.o.b. New York. Correspondence, Spanish.

5087—Automobile accessories and tools—Denmark. Purchase. Quotations, c.i.f. Danish port. Terms: Cash against documents.

5100—Fire fighting automobile of 70 horsepower, with a pumping capacity of 1,800 liters per minute—Sweden. Purchase. Quotations, c.i.f. Swedish port.

5106—Motor accessories and motor novelties — South Africa. Agency.

5108—Hardware, machinery, automobile accessories, etc.—Australia. Agency.

5132—Automobiles, shelf hardware, industrial chemicals, tanned leather, etc.—Brazil. Agency.

5138—Low-priced automobile and spare parts, including tires—Turkey. Agency. Quotations, c.i.f. Constantinople. Terms: Cash against documents.

The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1, Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3, Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. LXIV. No. 11 FEBRUARY, 1923 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879.

MERITAS
MADE
THE FABRIC BODY

The Sensation of the New York Show

THE Meritas Made Fabric Body displayed at the Hotel Commodore during the New York Automobile Show undoubtedly was the subject of more real interest on the part of body builders and car manufacturers than any other single display.

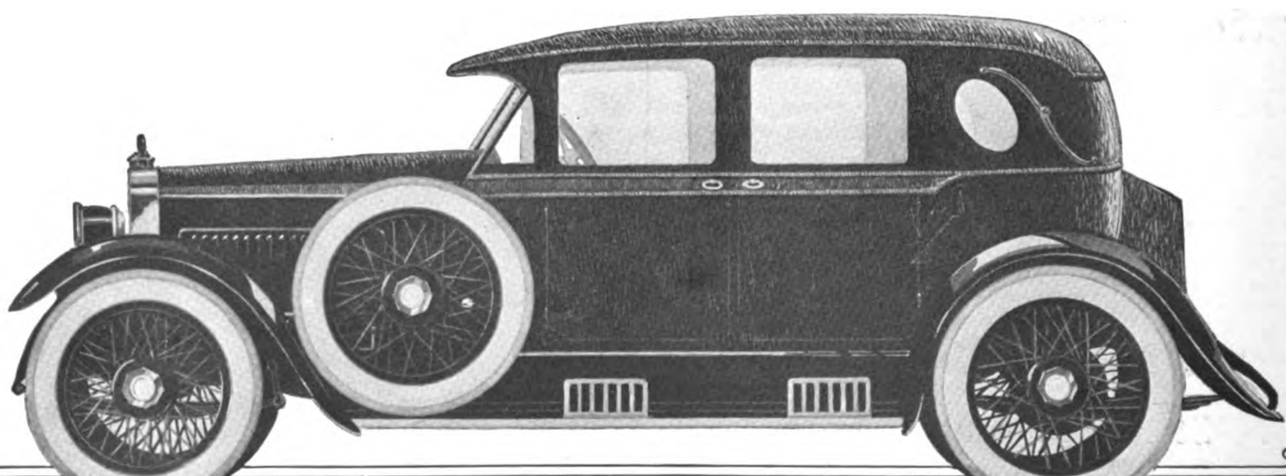
The most critical and experienced people in the automobile world have welcomed the idea of a body that can be produced at a lower cost, in less time than is required for metal bodies, and at the same time, elegance of appearance is not sacrificed.

With approximately sixty percent of car orders for 1923 calling for closed bodies, the Meritas Made Fabric Body looks like the answer to the big production problem.

We will be very glad to send a representative to discuss in detail the advantages of this type of body construction.

Booklet and samples of Meritas Leather Cloth sent on request

THE STANDARD TEXTILE PRODUCTS CO.
320 BROADWAY, NEW YORK
DEPT. A. M.



The Automotive Manufacturer

A Consolidation of The Hub and Automotive Engineering

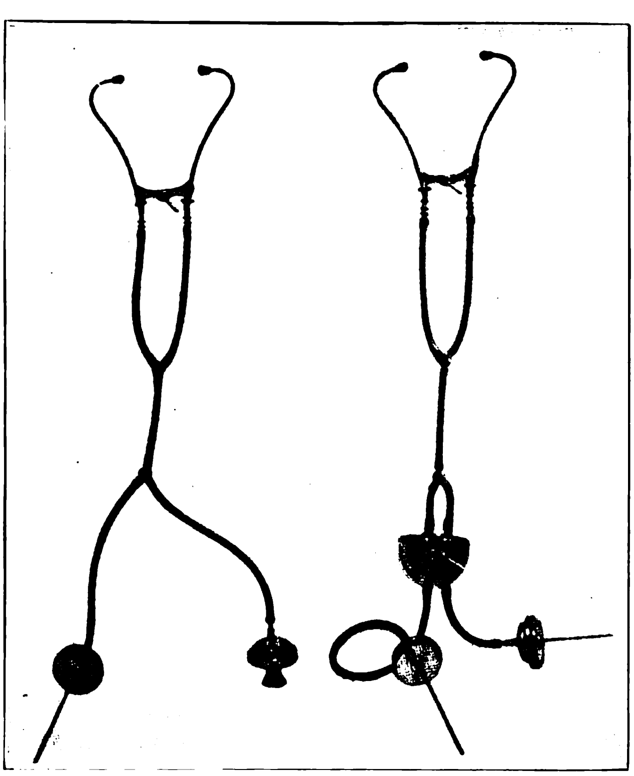
Vol. LXIV. NEW YORK, FEBRUARY, 1923 No. 11

Detection, Location and Comparison of Sound

BY C. E. NOEL-STORR*

Methods by Which Sound Has Been Measured in Past Not Now Sufficiently Thorough—Scale of Noise or Lack of It Needed—The Tectoscope

NOISE or any audible sound is admittedly an enemy of the modern automobile, from a sales standpoint, and designers have sought in every possible way to reduce that these efforts have been successful although not to the extent that anyone could say, truthfully, that all noise had been eliminated from the modern car. Some measure of success may be noted in the fact that one of the highest priced cars is sold practically upon its deserved reputation as noiseless. The sleeve valve motor in its various forms owes more of its popularity to the fact that it makes less noise than a poppet valve engine than to any other one thing. The overhead valve arrangement, admittedly more powerful, was held by for years by the fact that it made more noise than the conventional arrangement. Many friction transmissions gained their popularity through being noiseless rather than through any elimination or simplification of gear shifting. Other units have won recognition because they made less noise than those which they were designed to replace.



Figs. 2 and 3. Standard 1923 Instruments arranged for comparison.

From all of which it will be admitted that noise, or rather the lack of it, is an important subject to the automotive manufacturer. With this thought in mind, the following paper, practically in full by a prominent British engineer, is presented on its merits.

The necessity for the quick and accurate location of the origin of vibration and the accompanying sound on machinery in general being obvious, it is astonishing that so little effort appears to have been made to devise instruments for this purpose. Every engineer concerned either with the design production, or maintenance of machinery in any form must at some time or other have urgently required an instrument to detect or locate faulty or worn parts, or possibly a part which was defective in design for the work it was called upon to do.

For a very considerable period, probably dating from the inception of the steam engine, it has been, and for that matter is still, common practice to attempt location by means of a thin wooden or steel strip, one end of which is placed between the teeth clear of the lips, while the other is applied to the suspected part. When employing this crude method the ears are closed by the fingers so that the sound is conducted to the auditory nerves by the teeth and jaw bones. The difficulty and inconvenience of applying such means are obvious, while the results in most cases are very unreliable owing to the damping of the sound waves or vibrations.

An improvement on the above method consists in using

*Managing Director of the Capac Co., Ltd., London. A paper presented to the Coventry Branch, Inst. of Production Engineers.

a wooden rod which may be fitted with a steel contact pin at the lower end and which is arranged to carry a wood or fibre disc at the top. This serves as a crude form of ear piece, and the results obtainable are certainly better than when using the first method, though many of the difficulties of application remain. The author is unaware of the date when this method was first introduced.

A similar device with a hollow tubular stem and a cup-shaped ear piece has also been used, chiefly by hydraulic engineers for the detection of the flow of liquid in pipes. This method appears to have given reasonably good results, mainly, no doubt, owing to the favorable conditions under which such tests can be made, both as regards the absence of external sounds and of mechanical sounds in the pipes.

Earliest Noise Location

A still further advance on the earlier devices was the introduction in America, about 1911, of an instrument called the "Sonoscope," apparently intended chiefly for the detection of knocks in automobile engines. The instrument consisted of a composition case in the form of an ear piece containing a metal diaphragm to which a series of thin steel rods could be attached.

There is no doubt that as regards definition the "sonoscope" was a distinct improvement on the former crude

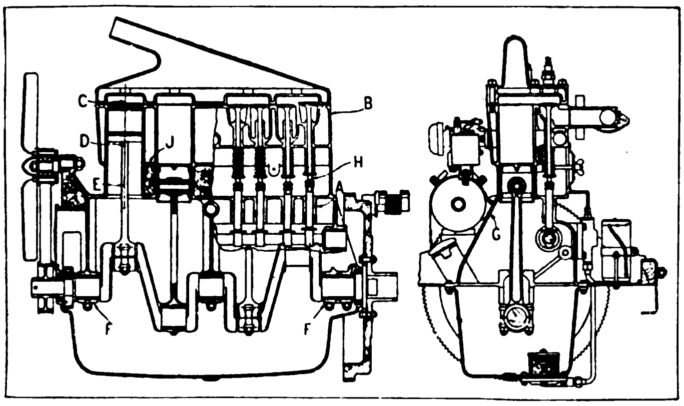


Fig. 1. Diagram of engine showing points of application of test rod.

devices. There remained, however, the disadvantage that as the rod projected at right angles to the face of the operator and it was necessary to close one ear either by the finger or by a cotton-wool plug, the actual application of the instrument to machines was unsatisfactory. Further, the practical impossibility of keeping the test rod in steady contact precluded application to many parts, as in the case of the gear box or rear axle of a car, or, in fact, to any part subject to considerable vibration.

As regards reproduction of the sound, the instrument was subject to a certain amount of drumming, while if the test rod were accidentally knocked, the diaphragm flexed with unpleasant results to the user. The above general types of instrument cover, as far as the author is aware, the available devices up to about 1915.

Before describing the construction and application of the latest Bin-Aural instruments it may be of interest to recount the circumstances that led up to the introduction of the improved types.

In the early part of 1916 a series of very large engines was placed in hand for tractors and similar purposes, and the author was severely taken to task on the score of defective carburetion when the first engine was placed on brake test. In the first place no attempt had been made to secure silence of operation, and when running under load the exhaust branch remained at or just below red heat. The determination of the actual cause of a pronounced knock was therefore, with any instrument then available, more or less a matter of guesswork. Attention to carburation having proved to the author's satisfaction that the real cause of the trouble was mechanical, it remained to devise some means of locating the sound under actual running conditions, the available types of instrument having bene tried without any marked success.

It was decided that the first essential was an instrument with two ear pieces and flexible connections to the reproducer. Even with this crude form of instrument the defect was traced with very little trouble and in perfect comfort both with regard to protection from heat and interference from external noises. Actually the time taken by the test was about 15 min., although from later experience it appears that the device was very far from efficient as regards construction and materials.

Only one further instrument was made at this time, and this was left with the engine-builders; the matter then rested for a considerable period, as other work occupied the whole of the author's time. Later, however, another problem arose in connection with small gear boxes which contained a double reduction spur gear mounted on ball bearings. As the speed of the primary pinion ranged between 7,000 and 10,000 r.p.m., it was not a simple matter to get reasonably silent operation, especially in view of the fact that the gear was only lubricated with stiff grease, the design and other considerations preventing proper arrangements being made. Under the circumstances it is not surprising that a certain number of boxes failed to pass inspection on the ground of excessive noise.

A difficulty also arose on account of the irregularity of the rejections, since batches considered noisy by the test room would frequently pass, while nominally silent batches failed to do so, due of course to the entire lack of any definite standard of reference for either the inspector or the works staff.

Damping Tried Out

Such considerations led to an attempt to measure the sound of the boxes by means of an attachment on the instrument already made. For this purpose the outlet from the reproducer was fitted with a sector valve which served to restrict the effective area of the pipe. As was anticipated, however, this method of damping was not sufficiently sensitive to give satisfactory results, but in view of the means adopted in the later instrument a brief description may be of interest.

It should be explained that the sector valve terminated in a pointer, and this in turn worked over a circular dial so arranged that the zero mark could be set in any position relative to the body of the instrument. In operation the test rod was first applied to an object emitting a sound of fixed intensity, as, for example, a watch or clock, and the pointer was moved so that the sound was just rendered inaudible; the dial was then moved so that the zero mark registered with the position of the pointer.

On the instrument being applied to a test part and the valve again being moved to render the sound inaudible, a definite position would be taken up by the pointer, and in view of the fact that a standard sound had been used to set the zero mark, it is obvious that two or more operators with widely different hearing abilities should obtain the intensity of the sound in terms of a figure which would

remain the same for any operator irrespective of his hearing capacity.

As stated previously, this ideal was far from being realized with the instrument as first constructed, and for this reason the device was useless for the purpose mentioned. It is of interest to record, however, that a description of the instrument was given in the Automobile Engineer (London), November, 1917, with some notes on the results obtained to that date.

Nothing further was done regarding the supply of instruments until February, 1921, although work had been steadily carried on with a view to obtaining at least some near approach to the desired results during the three-year interval. In February, however, a notice of a trial of one of the early instruments by a member of the Autocar (London) staff aroused very considerable interest both in this country and abroad, and steps were promptly taken to produce a number of instruments on a commercial scale.

The results otbained with these early instruments were, on the whole, satisfactory, but the suggestions of well-known engineers combined with further experiments and tests have enabled the accuracy of the latest type of instrument to be very greatly increased, and, as will be seen later, the application to everyday problems in the shop has been rendered much more simple.

General speaking, the construction of instruments for the detection and location of sound is complicated by the fact that in connection with mechanical work there are two distinct purposes for which such instruments may be applied, i.e., the detection of internal or mechanical sound and external or atmospheric sound. For example, suppose it is desired to examine the running condition of the balls in a journal bearing, the sound required is the internal and is quite apart from any external noise the bearing may make. Thus for this purpose the instrument must not reproduce any sounds other than those of the part to which the test rod is applied and should be sufficiently sensitive to give a clear indication of the sound, unaffected by reproduction and perfectly free from distortion or magnification. There is, of course, apparent magnification with the instrument, as the external atmospheric sounds are the only ones to which the engineer is accustomed.

It should be perfectly clear from the above, however, that as regards mechanical condition and when testing the operation of parts the actual or internal sound is required.

On the other hand, in many forms of construction it is desired to reduce the external noise to a minimum, and it is quite possible that a test of the internal sound may lead in such cases to a totally incorrect conclusion. Thus the construction or material of the casing may be such that a very considerable amount of internal sound may be quite in order as regards external noise, and, on the other hand, a minute internal noise may be distinctly audible externally if the casing happens to act as a sounding board. Judging by some forms of construction which have been seen from time to time, this side of the questions appears to be frequently neglected. To deal with the two distinct aspects of the matter, there are two different types of reproducer.

The Tectoscope Device

In the first place, there is the tectoscope, which is arranged with a test rod and reproduces only the internal sound of the part with which the rod is in contact. The Tectophone, on the other hand, is arranged with a conical mouth and reproduces the external sound when the mouthpiece is held close to any object.

It will be noted at once that one instrument serves to check the results obtained with the other. For example, the contact breaker of a magneto will show a considerable blow from the rocker arm when tested with the 'scope, but except on a few very silent engines the blow will not be heard externally when tested with the 'phone. In other words, the first instrument will indicate that there is a distinct mechanical blow taking place, and the second test will show that in the matter of improving the general silence of operation this blow is of small moment.

The above example serves to illustrate that the clear reproduction of even minute internal noises should enable worn or faulty parts to be located quite easily, while it also brings forward the use of the second type of instrument for checking the amount of external noise arising from a given internal source. Thus parts which may give rise to external noises may be traced, although it is more

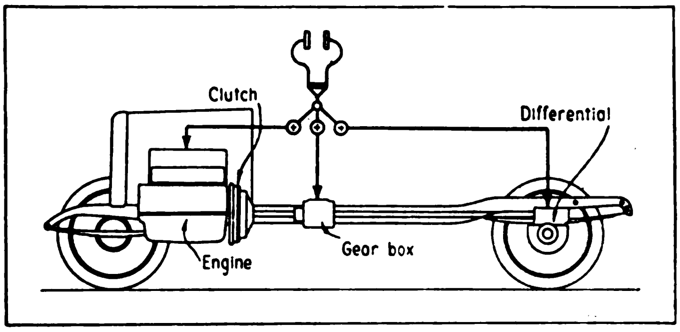


Fig. 4. Diagram illustrating general tests on chassis.

than likely that in some cases the internal cause is of small magnitude.

There are other general applications of the tectophone; for example, there may be two universal joints on a common shaft, and either or both may be dry and noisy. In some cases of this nature the tectoscope applied to the nearest bearing on the shaft might fail to give a clear indication on account of the noise of the bearing, but if the tectophone is held quite close to each joint in turn the squeak can be instantly located. The above instance applies to many similar problems and includes the tracing of gas, compressed air, and similar leaks from pipes and plant in general, the flow of a liquid in the pipe being indicated quite distinctly by the tectoscope.

The tectoscope consists of a head frame carrying tubes ending in a Y-connector, from which a single tube is carried to the reproducer. The head frame is fitted with rubber ear tips, and may be either of the folding or hinged adjustable pattern, while the connecting tubes are of special rubber with very thick walls, and are only affected to a slight extent by contact with oil and grease.

On reference to the details of the tectoscope reproducer it will be noted that the alloy diaphragm is housed in a metal case, the lower end of the anvil being fitted with a rubber gland forming a watertight joint and also preventing damage should the test rod receive an accidental blow when in use. Two types of this device are now in general use, the normal pattern and the sensitive type. The last named type is used for many special purposes and appears to be the most suitable for detection of water flow.

In the case of the tectophone the metal case is fitted

with a mica diaphragm, the general construction being arranged to provide a narrow sound focus.

Either of the above instruments may be interchanged on the head frame connections, and, as will be seen later, both types may be used at the same time when it is desired to compare the internal and external sound of a part.

To provide special protection for the operator in the case of marine or similar work, rubber ear cups can be used in place of the ear tips, and although there is some small loss of efficiency this is more than compensated for by the protection afforded should the user fall or should the tubes be caught in any object. In such emergencies the large rubber cups which entirely cover the ears will in the case of a sudden pull on the tubes simply pass over the ears when the frame will be clear of the head.

Application to Automobiles

With regard to the application of these instruments, it is, of course, impossible to deal with more than a few specific cases, and as, no doubt, the automobile branch will be of considerable interest, most of the examples have been taken from this class of work. The object throughout, however, has been, as far as possible, to illustrate general lines of application in connection with each series of tests.

Before attempting any actual testing, it is perhaps advisable to apply the instrument to simple objects, as, for example, a watch or clock, the contact breaker of a magneto, or the bearings and brush gear of a dynamo, noting the sound in each case. After a few minutes employed in this manner the instrument will be found perfectly simple to use.

Actual tests may then be made on an engine, the tappet clearance being noted by application to the guide near the base, A, Fig. 1, testing each tappet in turn and following by taking the closing of the valves at a point opposite the seating B. Another instructive test is the determination of the piston clearance, which is carried out by applying the instrument to each cylinder at about the level of the top ring when the crank is on top center C, a second test being made at half stroke D, followed by another at approximately 1 in. from the base of the cylinder E. In these tests it must be borne in mind that the maximum "slap" will be heard on the thrust side of the cylinder.

The condition of the little end bearing and the rings can be ascertained from the tests at the last positions, while with regard to the main bearings F the position of the crank case webs will indicate the most suitable point for the application of the test rod. The big end bearings are frequently clearly indicated at G near the top of the crank case on the side following the direction of rotation, while the front and rear main bearings may in the majority of cases be reached directly.

A point of interest is that a faulty tappet clearance will often give a distinct indication when testing the timing gear.

So far only the internal noise of the parts has been considered, and to make the application of the tectophone clear, the external noise from the impact of the tappet head against the valve stem H should be noted and compared with the internal noise of the cam and tappet A as given by the tectoscope. An instrument is shown in Fig. 2 with the two reproducers arranged for the above test.

A further point requiring consideration in testing the position clearance is the possibility that one or more are distinctly slack. In such cases if the test rod is applied, not on the vertical center line of the cylinder but exactly between two cylinders J, the piston "slap" will be heard for each cylinder, and the difference, if any, can be easily detected. This method may be used on many kinds of work, and enables sound to be readily compared by choosing a suitable application point.

Having dealt with a few simple applications covering tests of a common type, it will perhaps be best to consider the comparison of two or more sounds, either with each other or with a standard which is to be taken as a fixed quantity.

Difficulty of Locating Many Sounds

In the first place the great difficulty of locating mechanical sound is overcome by an instrument with which it is possible to pick out any one sound and trace this to a maximum. At the same time, as in the case of piston clearances, it is quite possible to find the worst offender, and after lifting the cylinder block and replacing the defective piston, to find another one which stands out quite clearly and to have to repeat the operation. Further, when it is a matter of personal opinion, several persons will rarely agree as to the cylinder giving the most pronounced "slap," that is, if there is only a slight degree of difference.

As previously mentioned, the first attempt to compare sounds was by the use of a sound of standard intensity for setting the zero, after which the scale reading was taken. In the place of this all general shop tests are now made in a very simple manner, a pair of reproducers connected to the head frame being used; and it will be obvious that if the left-hand reproducer is placed in contact with No. 1 cylinder, the sound emanating therefrom will be the only sound audible to the operator. On placing the right-hand reproducer in contact with No. 3, however, the relative "slap" of the two cylinders can be instantly compared, this being preferable to an attempt to remember the relative intensity of No. 1 and making a mental comparison after testing No. 3.

It will be at once appreciated that the above general method enables a series of valuable comparative tests to be made with no great expense as regards time or preparation. Also the comparison may be made with regard to another part of the same mechanism, or to a special check component which is kept for such purposes. Reverting to the question of piston clearance, the method certainly makes it possible to determine with certainty if more than one piston should be changed, and there should be no need of a second rejection because a noise which was at first overlooked stands out after the major noise has been corrected.

It should also be noted that when required the method enables the internal sound to be compared with the external; and as in some forms of construction the section or shape of the casing may cause, say, four tappets and cams which are all of equal intensity internally to give very different external effects, the combined test should enable any confusion to be avoided as to the actual cause of the defect. In fact, it should be of considerable assistance in the industry for purposes as widely different as the choice of suitable material for the exhaust pipe and the design of a gear box lid.

(To Be Continued)

Low English Sporting Body For American Chassis

Speedy Appearance of Light Sporting British Two-Seater on Nash Chassis Furthered by Streamline Body With Special Rear Deck

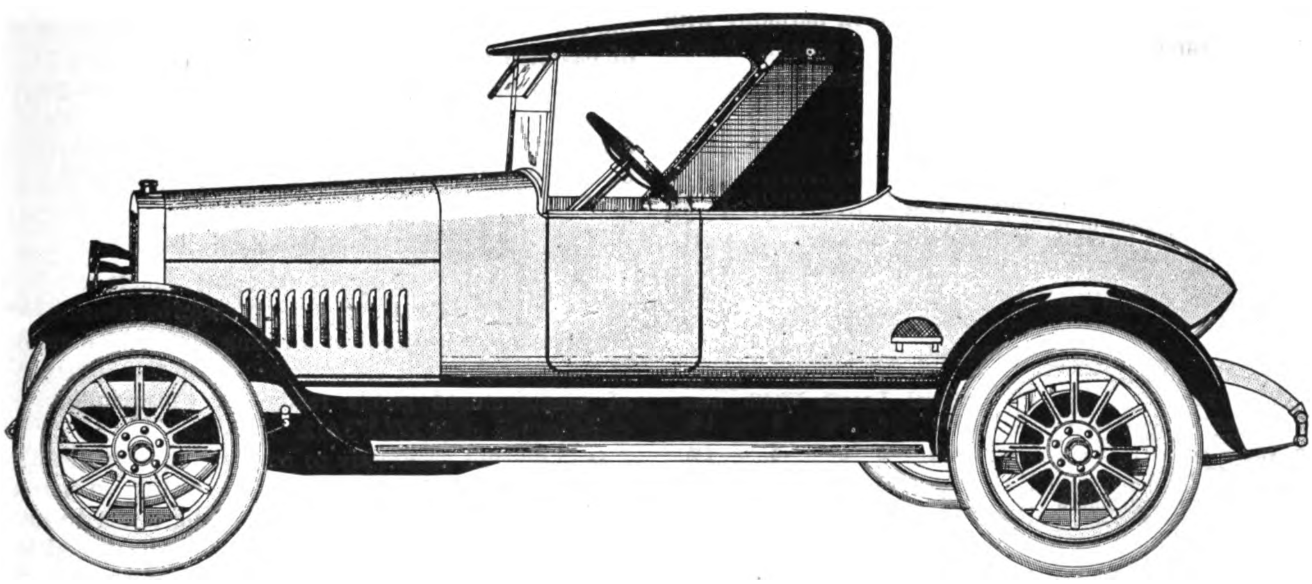
TWO of the things most sought after by recent designs of body, and generally by designers of sporting bodies, are the long low effect on the one hand, and the elimination of all molding or projections on the other, combined with streamlining of the body both at the hood and radiator end and in the rear. This latter brings about the appearance of great speed, as well as actually permitting higher speeds through the reduction of wind resistance.

For these reasons, the sporting type of body is constantly being used for experimentation by body designers. Some of the results achieved have been most happy, others not so good, and of still others the less said the better. In the body shown herewith, a British product on an American chassis, the Nash six-cylinder, it would seem that the designer has approximated the desired and desirable result.

Commenting on this special semi-sporting body, **Cooper's** Vehicle Journal (London) says that speed and reliability are now accepted facts, so that more attention is being devoted to other features of chassis design that materially assist in the formation of bodywork, not only serving to give more protection and accommodation for the driver, but also the passengers to be carried, and ensuring that its shape is such, that the surfaces do not seriously give rise to discontinuity, and in the motion of the car, that the air currents have a tendency to follow the contour of the body. All practical body designers realize to the full that it requires more power to drive a clumsily or badly shaped body, in comparison with that in which the lines have been studiously laid out to avoid as much as possible all eddy currents. These requirements have given rise to stream line formation with the tapering tail end, indeed the best results can only be obtained when the chief features of chassis formation such as wheel-base, shape and position of radiator, bonnet, dashboard, etc., combined with suitable measurements are such that will lend themselves to the best standard, but which unfortunately in a great number of chassis at the present time are far from satisfactory, when a graceful external appearance with the maximum seating accommodation is required.

In the design under notice, the long tapering tail end has been well maintained, but of a size and shape that a top folding flap may be fitted to lie flush with the upper deck panel, the dicky seat being built up off the floor. The light narrow molding introduced following the body lines of the back part, the line of mudguard, and at the top the raised portion of the seat, all make for smartness, giving some style and refinement to the body lines, without destroying the desired and essential features necessary for speedy driving.

Other features of the design closely follow the usual touring car practice, by having a light three-stick hood, secured, when raised, by a locking joint on the top of the wind screen. The all metal windscreen has the lower deflector panel carried to the bonnet line, the standard fixing being through the scuttle rail. These additions with the mudguards and running boards on standard lines make the complete car, one of general utility, and therefore will appeal to a large section of motorists.



Full side view of semi-sporting British roadster body on Nash six-cylinder chassis.

The construction of the body in its framework and panelling is necessarily light in weight, and it is not an uncommon practice to finish the whole of the panelling in burnished aluminum, but under any conditions aluminum of guage 20 is preferable for the panels, fitted to the light ash framework. The bottom sides will have to fit the rear up-sweep of the frame, and here much care is required in fitting, in order that there be no possibility of any creak, causing a looseness if a proper fit is not obtained. After the cross bars have been framed the standing pillars are lapped and screwed on the bottom sides, they should be braced together temporarily, while the elbow rails and back pillars are framed, following which,

the tail portion is built up with light ash battens, spliced and lapped together to the required shape and width, keeping all rails and battens of a uniform width and thickness 1¼ in. by ⅞ in, rounding over the inside edges between the joints, so that the rear part, when panelled, is nothing more than shell, stiffness and strength being obtained by the fixing of the panels that form the sides and after-decking of body. The front seat of the body is built with the swept rail of back spliced on to the side rails, supported by battens at the back. In front of this a 5 in. case is fitted, made from ½ in. white wood. This, when the back squab is fitted, brings the driver into his proper position for steering, while the case is particularly useful as a receptacle for all small parcels. The top cross rails of the back part are let on so that the flush lids may open in two parts, to give access to the dicky seat.

The scuttle rail, which is framed to the front pillar tops by a lap joint, will have to be carefully got out to a sweep that will give the required line of scuttle to harmonize with the bonnet line, therefore it is essential to clearly lay out these lines on the full size drawing, so that the battens are correctly fitted and shaped to the rails of body and dash, and serve as a guide to the metal workers in fitting the panels, which can be put on in three pieces. After the panels are fitted the aluminum bead is fixed, in which the utmost care is required in shaping to the lines required in order to produce a proper effect and in harmony with the whole design. Other particulars of passing details can be obtained from the table of measurements.

General Dimensions

	ft.	in.
Length from dash to back of body	8	7¾
Length from dash to shut pillar	2	9¾
Length from dash to back of driver's seat	4	9¾
Depth of case at back of driver's seat		5
Depth of body side in center of doorway	1	11
Total depth of body in center	2	4
Head room above the seat board	3	5½
Width of doors	1	8
Width over all at shut pillar	4	2
Width on bottom	3	9

Details of Framework

No. of Pieces	Part	Material	Length	Width	Thickness
2	Runners	Ash	8 7½	6	1⅛
—	Bottom sides	—	—	—	—
3	Cross bars	Ash	3 6	4	1⅛
—	Rocker pieces	—	—	—	—
2	Front standing pillars	Ash	2 1	1½	1¾
2	Hind standing pillars	"	1 11	1½	1¾
—	Hinge pillars	—	—	—	—
—	Back pillars	—	—	—	—
—	Pillar tops	—	—	—	—
2	Corner pillars	Ash	2 2	1½	1¼
4	Door pillars	"	1 9	1¾	1½
2	Door rails	"	1 7	1¾	1½
—	Door top rails	—	—	—	—
2	Door bottom rails	Ash	1 7	4	1⅛
2	Door battens	"	1 8	1	1¼
—	Cant rails	—	—	—	—
—	Front top rail	—	—	—	—
1	Front middle rail	Ash	3 5	1½	1¾
1	Back rail	"	3 9	1¾	1¼
2	Hind top rails	"	3 9	1½	1
3	Hoop-sticks	"	2 6	51	1¼×1
8	Body battens	"	3 0	1¼	1
5	Scuttle framings	"	1 1	1	¾
2	Seat rails	"	3 11	1½	1½
—	Panelling	Aluminum	60 ft.	super.	20BWG
—	Roofing	—	—	—	—
—	Flooring	Deal	18 ft.	super.	¾
—	Lining boards	Pine	20 ft.	super.	¼
—	Solid sides	—	—	—	—
—	Step pieces	—	—	—	—
—	Polished fillets	—	—	—	—
—	Inside panelling	Whitewood	10 ft.	super.	5/16
—	Canopy bends	—	—	—	—
2	Running boards	Amer. Ash	6 0	10½	⅞
—	Rocker sides	—	—	—	—
—	Screen pillars	—	—	—	—
—	Heel boards	—	—	—	—

Late but incomplete information received from Honolulu by the automotive division of the Department of Commerce gives the number of automobiles in the Hawaiian islands as 15,000.

May Tax Gas Instead of Cars

The substitution of a duty on motor spirit for the present system of vehicle taxation in England has been suggested to the departmental committee on the taxation and regulation of road vehicles, by representatives of car owners and dealers and seems to be meeting with much favor.

The main feature of the scheme is that a flat duty per gallon be placed on all imported motor spirit, with provision for free importation under license of spirit for motorboats and airships, which do not wear out the roads, and that the present tax per car be abolished or greatly reduced. It is alleged that a duty of 5d a gallon will produce £10,250,000 revenues in 1924, sufficient to offset the present car tax, the collections of which are used for highway purposes.

The main argument in favor of the scheme is that it would distribute much more equitably than the present system the burden of taxation on motor car owners. The existing tax, it is pointed out, is the same whether a car travels four hundred or forty thousand miles per annum. It is quite conceivable that an owner who has more than one car might pay the full tax on a car which had been used but two or three times during the year. The fuel tax, on the other hand, takes into account automatically the horsepower, speed, and weight of the vehicle, as well as mileage. The proposed duty would bear directly on the car owner in proportion to his use of the road, evasion of payment would be impossible, and penalizing of users of motor spirit for other than vehicular purposes would be averted by the permission to import free under license for their particular use. Vehicles without internal combustion engines would continue to be taxed as at present.

Auto Exports in 1922

Exports in 1922 of all automotive products which come under the jurisdiction of the automotive division of the Department of Commerce, totalling $110,659,626 amounted to 8.4 percent of the total exports from the United States of manufactured goods ready for consumption, which were valued at $1,292,373,412.

It is difficult accurately to compare exports during 1922 with those of the previous year owing to numerous changes in classifications, but from the totals an increase of 22 percent was registered. It must also be taken into account that prices were considerably lower during 1922, and that the increase in quantity was considerably higher than 22 percent.

Ford Buys Allegheny Glass Co.

Allegheny Plate Glass Co., with extensive factory space at Glassmere, Pa., near Pittsburgh, has been sold to the Ford Motor Co. The plant, built in 1919, is said to be one of the largest in the world. Its entire output will now be used for Ford products, solely.

License Plate Contest in Buenos Aires

There is a contest for the selection of luminous license plates which will be adopted by the motor vehicles operating within the municipality of Beunos Aires. This contest will last for six months commencing Jan. 6. Contestants must pay their own expenses, the prize being the acceptance of the license plate by the commission. Registration is over 80,000 motor vehicles.

Bulk of American Cars Built by Six Concerns

The bulk of American motor cars in 1922 was produced by six leaders which made something like 83 percent of the total output. Hence the business of about 96 percent of motor car builders was about 17 percent of the total production. But last year the industry could not produce machines fast enough to meet the demand and overflow orders undoubtedly added much to the success of the 96 percent. Possibly that surplusage of orders may not reoccur as millions of dollars were expended in adding to plants of the leaders during last year. A late comparative estimate of production in 1921 and 1922 is as follows:

	—Production—	
	1921	1922
Ford	1,013,000	1,352,000
General Motors	302,000	454,000
Dodge Bros.	89,000	165,000
Studebaker	51,000	110,000
Willys-Overland	51,000	99,000
Hudson-Essex	14,000	60,000

Thus it appears that six companies produced 2,240,000 of the total of 2,400,000 cars and trucks manufactured last year, against 160,000 by all others.

As the annual reports of last year's doings will not be published for some weeks, it is interesting to run over some of the estimates of what was done. Ford, a closed corporation, entered the new year with something like $150,000,000 cash after paying for the acquisition of valuable coal lands, and with excess of assets over liabilities of $289,000,000. Ford money and system will make sleepless nights for some of its competitors.

General Motors is the greatest motor concern in which the public may cooperate in the automotive business. Its stockholders own its four classes of shares: $16,183,000 of 6 percent cumulative preferred callable at 110; $60,801,000 of 6 percent cumulative debenture stock callable at 115; $23,831,000 of 5 percent cumulative debenture stock callable at 120, and $20,831,000 of no par value common stock. There is no funded debt ahead of the shares, but a $12,000,000 mortgage on the Detroit headquarters building of some 1,400,000 sq. ft. of floors.

General Motors converted a $65,000,000 deficit of 1921 into a net profit of $57,000,000 in 1922; that is about $2.35 for each share of common stock. It accomplished that feat after defraying some $45,000,000 of bank loans and now has $130,000,000 of working capital. It is managed by some of the leading industrial brains of the nation—men like the Du Ponts, Irenee, Baker, Paskill, Lamont, etc.—while its financial policies are sponsored by J. P. Morgan & Co. One out of every six cars in the United States is of General Motors make, and, other than the low priced Fords, one out of every four cars was turned out by this giant.

Easily may we see the retirement of the preferred and debenture stocks, as their present prices are not as much as the company's working capital. For more than a year, financial prophets have been suggesting that General Motors may become in the automotive industry what the United States Steel Corp. is in the steel enterprise.

Studebaker is alive and full of energy. It has no funded indebtedness, $9,450,000 of 7 percent cumulative preferred stock and $75,000,000 of common stock outstanding, which was increased from $60,000,000 by stock dividends in December. The company closed the last fiscal year, June, 1922, with $22,943,000 surplus, some 7,000 shareholders, while its old common stock ($60,000,000) earned $16.25 for last year and possibly $27 for the present year.

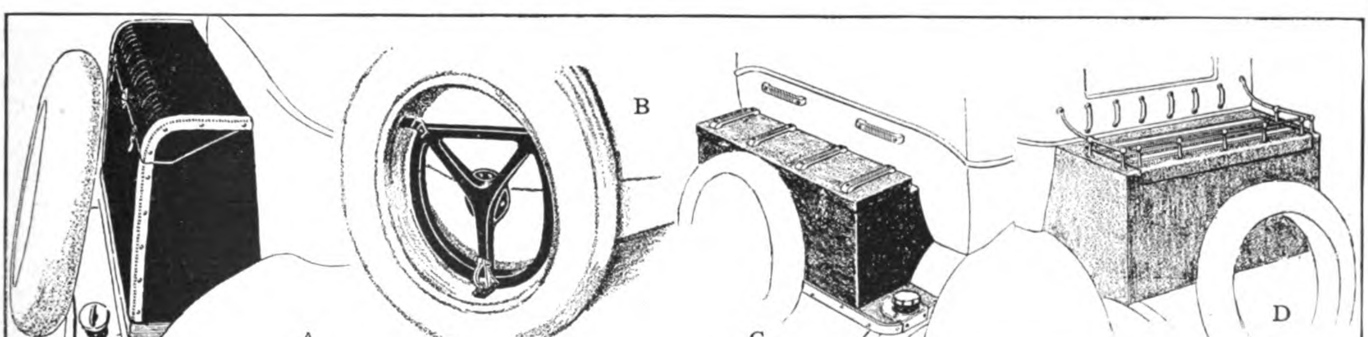
Willys-Overland recuperated markedly during the past twelve months. It reduced its deficit by $16,000,000 to approximately $8,000,000, which is reported, underwritten at maturity. Hudson finished the last fiscal year, November, 1922, with $7,200,00 of net earnings; that is about $6.02 per share. It has $7,233,000 cash, no funded debts, and $5,289,000 of surplus. Maxwell apparently has sloughed off its Chalmers troubles, cut its deficit in two, has $6,000,000 of cash, and reduced its serial notes to manageable proportions.

Chandler earned about $8 last year. There is no funded debt, and no preferred stock. Pierce Arrow ended with a deficit of $375,000 against a deficit of four odd millions in 1921, but claims bettering prospects. Thus the automotive industry improved markedly in 1922, and the prospects for 1923 are very bright indeed. Prices are more reasonable than a year ago. Marked demand for cheaper and medium priced cars and for trucks is expected

Windshield Improvement Wanted in India

Complaints against the character of monsoon-shields come from Bombay. The Indian monsoon is a wet wind which brings joy to the agriculturist, for without it Indian crops dry up and disappear, but it depresses the motorist who, according to the Times of India, have to take refuge behind cumbersome, badly designed affairs of canvas and mica which make driving a hazardous affair for the driver and envelops the rear seat in darkness black as night. One-man tops ought to have a good sale in the monsoon season.

Some of the New Rear Ends Seen at the Show



The newer sport bodies and touring sedans all have rear trunks and this is stimulating their even wider use. The sketches above show some of the new rear ends. At A is the Cadillac landau-sedan. This trunk has rounded corners. B shows the new Marmon pressed-steel tire carrier. C is the built-in trunk on the Nash four-door coupe. Special trunk guard rails to permit the use of the top surface of the trunk are used on the R & V Knight.

World Total of Motor Cars Close to Fifteen Million

New Record for Total Number of Cars Registered in United States Runs Up World Totals to Astounding Figures—Cars Increasing Faster Than Population—North America Has Almost 87 Percent of Whole

WHEN a person glances over the total number of motor vehicles in use in the world today, the surprising fact which is at once noted is not the astonishing number of vehicles in use but rather the tremendous proportion of the world's total which are in use in this country. In actual figures, it goes above 85 percent, and if Canada be considered with the United States, that is taking North America as a whole, it goes above 87 percent.

All these facts will be noted in the world summary given herewith, but the average person will be more interested in the detailed figures for the United States, given in the large full-page table. This shows an increase for each and every state ranging from New Mexico with a numerical increase of but 693 which is 2.8 percent up to the District of Columbia which added 23,680 or 38.3 percent. The biggest number was added in New York, 248,208, with California a close second, having added 167,833.

New York continues its leadership with slightly more than a million. Four others, Ohio, California, Pennsylvania and Illinois, also exceed three-quarters of a million, with two more, Michigan and Texas, exceeding half a million and Iowa lacking but a couple of hundred to get into that favored class. If it be considered that Great Britain has less than three-quarters of a million, while all the rest of Europe can not muster more than six hundred thousand, the hugeness of the totals in the various larger states, the visible sign of our prosperity, becomes more and more apparent.

The country as a whole gained 17.5 percent or 1,835,660, but the rest of the world gained at a slightly faster rate. The total balance of the world gain was but 464,340 but this is rendered into a large percentage because the previous total over which it represents the increment is but 2,054,215. New York, Ohio and California together exceed the rest of the world, outside of the United States, by nearly two hundred thousand.

The gain for 1922 exceeded the previous record year, 1919, when the gain was 1,655,594, by more than 10 percent. For seven consecutive years the gain each year has been above a million, net, and for the last four years it has averaged more than a million and a half, 1,584,000 to be exact. These two facts taken together show upon what a high production plane the industry has now been reached. This year's production was 2,527,000 but as the registrations show but 1,800,000 net addition, the other 727,000 must have gone into the replacement of obsolete vehicles. This annual replacement figure has mounted continuously until it is now approximately equal to the entire production total of the industry in 1915, a short 7 years ago.

Considering that the year's total averaged more than 150,000 a month net addition, and as this is written near the end of February, approximately 300,000 will have been added since the end of the year for which the tabular totals are given. This then gives an up-to-the-minute total for the United States at the end of February of almost exactly twelve and a half millions. On the same basis, the world totals are increasing at a rate exceeding 190,000 per month so the end-of-February total easily exceeds fifteen millions.

The surprising fact about these figures is that when taken in conjunction with population figures, they show a much faster rate of increase of use of cars than of population. In other words, more cars are added to the total in use in this country each year than there are people added to our population, considered on a percentage basis. This means that a larger and larger proportion of the people possess cars each year. Not so very long ago, when our population was put down at 100,000,000, it was considered that this represented roughly 20,000,000 families. In 1920, when the population was 105,710,620, the number of families was put down as 24,351,676, the government census figures showing an average of 4.3 persons per family. The normal rate of population increase would bring this to 25,581,000 for 1923 so that the number of cars in use today represent almost exactly one for every other family in the entire country. This is only a statistical and not an actual fact, however, the truth being that so many wealthy families have more than one car, that it

Distribution of Motor Vehicles in the World

Rank		1919	1920	1921	1922
1	United States	7,601,036	9,211,295	10,445,785	12,281,445
2	Great Britain	255,000	297,500	497,500	597,500
3	Canada	341,316	398,000	469,496	540,000
4	France	202,000	232,300	242,500	255,000
5	Australia	27,000	31,800	81,000	125,000
6	Argentina	26,500	31,000	70,000	100,000
7	India	18,680	22,480	45,983	65,000
8	Germany	75,000	75,000	75,000*	60,000
9	Italy	35,500	39,800	53,000	60,000
10	New Zealand	25,000	29,500	37,500	44,000
11	Spain	14,850	16,000	19,650	41,000
12	Cuba	22,000	25,900	31,800	39,000
13	Brit. S. Africa			31,000	38,000
14	Mexico	16,500	18,480	24,480	32,000
15	Netherlands	20,000	22,000	21,000	25,000
16	Brazil	12,500	14,000	18,700	24,000
17	Belgium	12,000	13,400	18,500	24,000
18	Switzerland	14,000	16,100	18,011	21,000
19	Dutch E. Ind.	12,500	14,000	17,500	20,500
20	Austria	19,300	19,300	19,300*	19,300*
21	Norway			14,340	19,000
22	Philippine Isl.		15,709	16,800	18,500
23	Sweden	10,000	11,200	14,250	18,000
24	Denmark			14,000	16,500
25	Hawaii			12,500	15,500
26	Jugoslavia			12,260	15,250
27	Russia (in Europe)	15,000	15,000	15,000*	15,000*
	All others	104,318	110,236	165,645	170,510
		8,880,000	10,680,000	12,500,000	14,700,005†

* Lacking the figures, the older totals are repeated but unquestionably the numbers in Germany, Austria and Russia are less than the figures given.

† Under date of Feb. 12, 1923, the U. S. Department of Commerce, automotive division, estimated the world total at 14,612,161.

In all cases, the figures given are the latest available.

AMERICA'S AUTOMOBILE INCREASE AS SHOWN IN REGISTRATIONS FOR NINE YEARS

	1914	1915	1916	1917	1918	1919	1920	1921	1922
Alabama	8,425	13,798	22,354	32,873	46,155	58,898	74,637	82,343	90,052
Arizona	4,774	7,320	12,122	19,890	22,671	28,979	34,601	35,220	38,034
Arkansas	5,642	8,021	14,704	28,862	41,458	49,450	59,012	67,413	86,614
California	123,101	163,801	212,918	243,116	288,173	477,450	568,892	674,830	842,663
Colorado	17,951	26,611	44,180	66,850	70,000	104,863	129,255	145,370	175,000
Connecticut ...	26,218	38,950	56,048	74,642	84,902	102,410	119,134	135,460	149,659
Delaware	2,894	4,924	7,520	9,655	12,066	16,152	18,300	21,500	24,560
Dist. of Columbia	8,000	10,200	13,118	21,198	40,045	35,400	34,161*	61,745*	85,425
Florida	11,366	13,123	14,220	39,216	47,059	55,400	73,914	97,837	120,000
Georgia	20,800	24,059	45,775	70,496	99,160	133,051†	146,000	131,942	144,504
Idaho	3,272	7,093	12,996	24,316	31,925	42,220	50,861	51,300	53,807
Illinois	131,140	182,290	251,300	340,292	389,135	478,438	568,924	670,452	786,190
Indiana	65,500	96,915	139,138	189,433	277,160	277,255	332,067	400,342	470,530
Iowa	106,087	139,808	172,791	278,218	327,500	363,079	437,378	430,003	499,446
Kansas	50,467	74,956	114,364	154,442	186,109	227,752	294,159	291,309	327,194
Kentucky	11,746	19,500	31,500	47,400	65,884	90,008	112,683	125,672	153,500
Louisiana	3,500	10,880	20,014	31,650	39,355	51,000	73,000	80,000	102,284
Maine	14,300	18,000	28,951	38,499	42,154	53,425	62,907	77,530	91,710
Maryland	20,213	27,638	33,364	56,129	78,146	95,634	102,841	140,000	162,570
Massachusetts .	76,832	89,133	136,790	155,044	176,564	147,182	274,498	363,032	385,840
Michigan	76,389	114,845	159,639	215,001	261,167	325,813	412,717	477,037	578,980
Minnesota	67,365	91,829	137,500	191,500	201,127	259,734	324,166	328,700	383,000
Mississippi	3,894	11,500	20,474	31,650	40,000	45,030	68,486	65,120	75,470
Missouri	50,998	76,462	107,865	146,142	185,146	244,363	297,008	343,386	388,699
Montana	10,706	14,520	24,585	41,896	50,125	59,324	60,650	54,175	62,648
Nebraska	50,000	59,140	101,201	148,101	175,370	196,430†	219,000	242,557	256,654
Nevada	1,487	2,177	4,609	6,706	7,987	9,305	10,464	10,819	12,847
New Hampshire	8,738	10,819	14,338	18,146	20,458	31,625	34,680	42,500	48,576
New Jersey ...	58,820	67,556	75,108	87,421	129,011	190,873	227,737	271,605	341,626
New Mexico ..	3,000	4,947	8,208	14,086	16,893	18,082	22,100	24,780	25,473
New York	156,173	212,844	279,406	404,247	453,588	566,511	670,290	754,085	1,002,293
North Carolina	14,815	21,160	35,150	55,950	72,300	109,017	140,860	148,684	182,067
North Dakota .	17,348	24,678	41,761	62,993	70,531	82,885	90,840	92,643	99,100
Ohio	121,265	179,767	252,179	333,630	417,400	511,031	621,390	742,713	859,000
Oklahoma	7,360	25,615	52,718	100,199	120,300	144,500	212,880	221,300	250,444
Oregon	16,347	23,758	30,917	48,132	66,607	83,332	103,890	118,615	134,566
Pennsylvania ..	107,141	150,729	230,648	325,153	370,110	482,117	570,164	689,589	829,737
Rhode Island .	12,331	16,362	21,406	25,142	30,595	44,833	50,477	53,721	66,500
South Carolina	15,000	14,500	19,000	36,822	55,400	79,143	93,843	90,546	95,978
South Dakota .	20,080	29,336	44,271	67,158	84,003	104,628	120,395	119,262	125,238
Tennessee	19,668	27,266	31,400	48,500	61,500	80,422	101,852	117,025	135,745
Texas	64,732	90,000	197,687	213,334	250,083	331,310	427,693	467,788	526,569
Utah	6,139	7,994	13,507	21,226	27,204	35,236	42,616	47,500	49,156
Vermont	7,613	11,499	14,251	18,550	20,764	26,807	31,625	37,265	43,881
Virginia	13,985	21,357	35,426	55,661	72,228	94,100	115,470	141,000	169,000
Washington ...	30,253	36,905	62,546	93,822	119,905	148,775	173,920	186,170	217,111
West Virginia.	7,217	13,256	20,437	31,306	37,025	50,203	80,664	105,000	112,752
Wisconsin	53,180	81,371	117,603	164,531	196,844	236,290	293,298	342,060	388,044
Wyoming	2,428	3,976	7,125	12,001	16,150	21,371	33,926	26,900	30,709
Total	1,754,570	2,423,788	3,544,952	4,941,276	5,945,442	7,601,036	9,211,295	10,445,785	12,281,445
Gain during year	501,536	699,218	1,121,164	1,139,324	1,104,176	1,655,594	1,610,259	1,234,490	1,835,660

† Average of N. A. C. C., Automotive Industries and Goodrich figures.
* Not included in total.

is doubtful if more than one-third of the families of the country have a car.

In 1922, it was estimated that there were 3,000,000 motor vehicles on farms, 150,000 trucks and the balance cars. The year's percentage of increase applied to this would bring it up to 3,500,000. In 1920 there were 6,448,366 farms in the country. At the average rate of increase this total would now be 6,474,424, so that the farmer has his proportion of a motor vehicle on every other farm, and slightly more.

Judging from the facts that have been made public, automotive manufacturers are going forward from this splendid high level to an even higher level. Ford is planning a production which will exceed two millions, and all the other manufacturers are figuring on doubled or greatly increased production schedules. It would not be surprising to see the 1923 production total exceed 2,800,000, which would be distributed roughly on the basis of 900,000 to 1,000,000 replacements and 1,900,000 to 1,800,000 new owners of cars or trucks.

Manufacture of Carriages, Wagons and Materials, 1921

Production by establishments engaged primarily in the manufacture of carriages and wagons and materials amounted to $42,418,000 in 1921, as compared with $118,228,000 in 1919, and $131,547,000 in 1914, a decrease of 64.1 percent in value of products from 1919 to 1921, and 67.8 percent for the seven-year period 1914 to 1921. In addition establishments engaged primarily in other lines of manufacture reported the production of carriages and wagons and materials, valued at $2,741,000 in 1921; $13,921,000 in 1919; and $4,493,000 in 1914.

Of the 965 establishments reporting products valued at $5,000 and more in 1921, 139 were located in Pennsylvania; 128 in New York; 71 in Ohio; 52 in New Jersey; 48 in Illinois; 45 in Missouri; 42 in Indiana; 41 in Wisconsin; 33 in Tennessee; 31 in Massachusetts; 26 in Kentucky; 25 in Iowa; 22 each in North Carolina and Virginia; 20 in Maine; 19 each in Connecticut and Minnesota; 17 each in Georgia and Michigan; 15 each in Louisiana and Maryland; 13 in Rhode Island; 12 each in California and Texas; 11 in Alabama; 10 in Arkansas; 9 each in New Hampshire and West Virginia; 6 in Florida; 4 each in Colorado and Delaware; 3 each in Kansas, Vermont and Washington; 2 each in Montana, South Carolina and South Dakota; and 1 each in District of Columbia, Nebraska, New Mexico, North Dakota and Utah. Pennsylvania was the leading state in the number of establishments, but measured by the value of products, Illinois ranked first, reporting $5,014,000, or 11.8 percent of the United States total; Pennsylvania was second with $4,467,000; and Indiana third with $4,136,000.

In May, the month of maximum employment, 10,878 wage earners were reported, and in September, the month of minimum employment, 10,012, the minimum representing 92 percent of the maximum. The average number employed during the year was 10,535 as compared with 24,682 in 1919, and 52,391 in 1914.

The statistics for 1921, 1919, and 1914 are summarized in the following statement; the figures for 1921 are preliminary and subject to such change and correction as may be found necessary upon further examination of the original reports:

	1921[1]	1919[1]	1914[1]
No. of establishments ..	965	1,523	2,802
Persons engaged	13,317	30,697	64,446
Proprietors and firm members	1,047	2,867	5,629
Salaried employees	1,735	3,148	6,426
Wage earners (average numbers)	10,535	24,682	52,391
Salaries and wages	$15,497,000	$30,897,000	$40,331,000
Salaries	3,325,000	5,837,000	7,774,000
Wages	12,172,000	25,060,000	32,557,000
Paid for contract work .	132,000	182,000	209,000
Cost of materials	22,198,000	63,097,000	65,719,000
Value of products	42,418,000	118,228,000	131,547,000
Value added by manufacture[2]	20,220,000	55,131,000	65,828,000

[1] Statistics for establishments with products valued at less than $5,000 are not included in the figures for 1921; 500 establishments of this class reported 350 wage earners and products valued at $1,301,000. For 1919, however, data for 1,021 establishments of this class, reporting 619 wage earners and products valued at $2,671,000, and for 1914, data for 2,255 such establishments with 2,842 wage earners and products amounting to $5,714,000 are included in the figures with exception of the item "number of establishments."

[2] Value of products less cost of materials.

The following table shows a detailed summary and comparison of the products of the carriage and wagon industry for 1921, 1919 and 1914.

	1921	1919	1914
Products, total value.	$ 42,418,000	$118,228,000	$131,547,000
Complete vehicles of of all classes:			
Number	107,273	608,833	1,124,903
Value	$ 12,175,000	$ 56,174,000	$ 69,324,000
Carriages and buggies:			
Number	34,413	215,809	538,071
Value	$ 3,656,000	$ 19,676,000	$ 33,330,000
Wagons:			
Number	67,017	356,837	533,601
Value	$ 8,243,000	$ 35,184,000	$ 34,506,000
Business:			
Number	14,167	51,018	139,621
Value	$ 3,438,000	$ 6,920,000	$ 13,023,000
Farm:			
Number	52,618	303,231	384,663
Value	$ 4,715,000	$ 27,568,000	$ 19,708,000
Government, municipal, etc.:			
Number	232	2,588	9,317
Value	$ 90,000	$ 696,000	$ 1,775,000
Public conveyances:			
Number	161	194	1,221
Value	$ 49,000	$ 77,000	$ 280,000
Sleighs and sleds:			
Number	5,632	35,993	52,010
Value	$ 227,000	$ 1,237,000	$ 1,208,000
All other products ...	$ 30,243,000	$ 62,054,000	$ 62,223,000

Auto Show in Gothenburg in 1923

Beginning on March 9 and closing June 12 there will be held an international automobile show in Gothenburg, Sweden, under the auspices of the Royal Swedish Automobile Club and patronized by his majesty the king. Huge exhibition halls will be erected for the purpose, capable of housing 120 automobiles besides motorcycles, bodies, etc. Invitations have already been sent to foreign companies and there seems to be considerable interest for the exhibtion.

Book Review

Power Alcohol, by G. W. Monier-Williams. 323 pp., 5½ by 8½, 50 illustrations, cloth. Oxford University Press, American Branch.

The sub-title, Its Production and Utilization, gives a good idea of the scope of this work. The author takes up the various sources of alcohol, such as plants, starch, sugar, various grains, cellulose materials, then synthetic alcohol. Excise supervision and denaturation are covered from a British standpoint. The internal combustion engine and the properties of alcohol from a motor-fuel standpoint come next, and are followed by the results of such tests as are available. The final chapter deals with the more promising (at present) motor fuels, that is mixtures containing alcohol. It is a thoroughly well done job, although the chapter on the principles of the internal combustion might have been more useful if not written on such an a, b, c basic. Everybody nowadays knows how gasoline engines work; it ought not to be necessary for every author whose work touches even remotely on engines to explain all over again what every boy of 12 knows.

The Control of Quality in Manufacturing, by G. S. Radford. 404 pp, 6 by 8½, 90 illus., cloth. Ronald Press, New York.

The book deals with the commercial production of high quality that is accurate units, the author's contention being that accuracy or high quality and high cost are not necessarily synonomous. He takes up inspection in the shop of work in every stage of process and from every possible angle. In this he describes not alone the organization and management of the inspection department, and its methods of handling the work, but the various gages, jigs, fixtures, measuring machines and other tools used for inspecting and checking. The subject is approached from the standpoint of the executive who would be responsible for the quality of the product, as for instance. the vice-president in charge of manufacturing. This is indicated most readily by the titles of the earlier chapters, a few of which are: The Approach to Quality, Control, Inspection—The Need for Independent Scrutiny, The Types of Inspection, The Inspection Department in the Organization, etc.

Why Manufacturers Lose Money, by Robert Grimshaw. 176 pp., 5¼ by 7½, cloth. D. Van Nostrand Co., New York.

The majority of books relating to the conduct of business attack the subject from a positive viewpoint, and proceed to tell what to do and why, how this will make money and why, and generally lay down rules which, if followed, should lead to success. This author attacks the same subject from the reverse or negative standpoint, and proceeds to tell what not to do and why, how this lost money for certain firms and why, and generally lays down rules which have resulted in failure, and if followed are certain to lead to failure again.

He has classified the reasons why manufacturers have lost money into seven classes, and proceeds to describe and illustrate these by classes. The seven are: Financial, commercial, organizational, accounting, technical, personal and miscellaneous.

All through the book he follows the same negative plan, but the reader who will invert this and from the negative statements formulate his own positive rules will derive both pleasure and profit from the book.

Motor Vehicle Engineering—The Chassis, by Ethelbert Favary. 468 pp., 6 by 9, 515 illus., boards. McGraw-Hill Book Co., New York.

This is volume two, the same author's first volume being engines. It presents a very large number of excellent working drawings, in large sizes, so that the designer and draftsman will derive much benefit from the volume regardless of its text. The latter is a curious mixture of methematics, empirical rules and elementary, almost a, b, c explanations. If the book is intended for the designer much of the elementary material could be eliminated to advantage.

Modern Motor Car Practice, by W. H. Berry. 582 pp., 6 by 8½, 300 illus., boards. Oxford University Press, American Branch.

For this day and age, it is strange that any publisher would undertake the tremendous expense of getting out a work of this kind in the hope of large sales, for the day has passed when a purely general description of automobile parts and their functions is wanted or needed in large quantities. This book goes right through the car from the internal combustion and its cycles of operation, through carburetion, cooling, fuels, gear boxes, clutches, rear axles, frames, front axles, and all the other car units and parts, winding up with body work. Each of these is explained in detail, about as one would explain it to a child, no data, figures or specific facts being given. Many of the illustrations are too large, and a much greater number are much too small.

Custom Body Makers' Plans

With the offering of 43,000 shares of the Springfield Body Corp., the new combination of custom body builders, comes details of the organization. Priced at $45 the share, the capitalization has been divided into 50,000 of class "A" and an equal number of shares of common stock.

The corporation now owns a fully equipped body plant at Springfield, Mass., with a third unit now being built, which, when completed, will add more than 52,000 sq. ft. to floor space. A second large plant at Bloomfield, N. J., with 175,000 sq. ft. of floor space and 14 acres of land has been purchased from the General Motors Corp. In the near future it is expected to begin operations in a third factory at Pontiac, Mich., where a unit providing 283,000 sq. ft. of floor space has been leased under option.

French Car Builders' Bright Future

The salon at Paris marked the peak of the productive effort in the French automotive industry, which has made great progress in the recovery from past depression. Many of the large concerns now face a bright future. The capacity of the industry is estimated at 100,000 cars with actual output in 1922 placed at 50 to 70 percent. The French market is still flooded with stocks of motor trucks. The automotive industry, centered around Turin, remained active throughout the depression in most other metal industries, and took care of the greater part of the domestic demand. Fiat production in the latter part of the year was estimated at 65 cars per day.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIV FEBRUARY, 1923 No. 11

The Ultra-Silent Motor

NO ONE who has been connected with the production of motor vehicles for a period of more than 10 years will deny the great forward strides which have been made. And neither such a person nor the general watching and non-buying public will deny that one of the greatest of these forward strides is in the matter of silence. One close enough to car manufacturers to know what is going on in experimental rooms and in other places where next year's models and those for the year after are considered will admit as well that all future plans include an even greater measure of silence in motor car operation.

In short the quiet car has now become so much the accepted thing on the part of the buying public that it is demanding more and more silence, less and less noise, from each succeeding model turned out. Since noise in a way represents friction and wear, it follows that all steps taken toward the elimination of noise must automatically benefit the car owner in these other ways. The demand for less noise, of greater silence whichever phrase you prefer, then has a very common sense basis, and one moreover, which is economically justified.

Just as soon however, as one begins to compare noises, and to try to measure them, difficulties arise. It is true that it is easy to measure the relative noise from an old model and a new one by bringing them so that they are side by side, and then operating them either alternately or simultaneously. When it is impossible to bring together the two which it is desired to compare, how then is one to measure their relative noises?

Just as soon as we get into this subject of noises thoroughly and on a big scale it will be necessary to have devices for measuring the noise. And when these have been perfected, and their methods of use standardized, it will be necessary further to devise a scale of relative noises, and to assign to each operating unit a permissible maximum. All this gives point to the splendid article on the subject of sound, its measurement and prevention, which begins in this issue. Every automotive manufacturer should read it thoroughly.

Fifteen Million Cars in Use

ALMOST everyone, whether a car owner or not, will get a considerable thrill out of the off-hand statement of the number of motor vehicles. And when close inspection of the world figures shows approximately 90 percent of the world's motor vehicles to be in the United States, a patriotic thrill as well.

It is a fact that right now, as this is written, there are more than twelve and a half million motor vehicles in use in the United States, so that even the most recent population total gives an average of one car for each eight persons, or considering families alone, one for every second family. While that might sound to any pessimist as far beyond the saturation point, that mythical line which should have been reached years ago and which is supposed to mark the decline of the automobile and truck along the ways of the bicycle, the fact is that those most vitally concerned, the automotive manufacturers, are going cheerfully along planning to build, and actually building, more motor cars in 1923 than ever before. Ford has moved his production schedule up a notch and now plans to turn out two millions, while the other manufacturers have adopted schedules which will call for close to a million more.

From all apparent indications, the year 1923 will mark a new high level in car, truck and tractor production.

The Argentine Automobile Show

Two things struck the observer at the recent automobile show in Buenos Aires, says the Bulletin of the French Chamber of Commerce in Buenos Aires, were the comparative scarcity of light cars and the predominance of heavy powerful 6 to 8-cylinder machines, the type preferred in Argentine. Almost all the cars shown were complete and with closed hoods. This latter fact, says the French commenter, seems contrary to the object of such show, making it more of a body exhibition than a demonstration of mechanism. The body, he says, should be considered secondary, since it is made to suit the taste of the buyer, while the chassis is unchangeable and really constitutes the element of value in the car.

American cars predominated in the show, only a few of the best known European makes being exhibited, among them the Rolls-Royce, Armstrong-Siddeley, Wolseley, Fiat, Lancia, Ceirano, Opel and Hansa-Lloyd. A number of French cars for the exhibition failed to arrive in time, but the Renault and Citroen companies had well chosen exhibits and a Berliet chassis was shown.

Speed Limiters for Argentine Automobiles

The municipal council of Buenos Aires has passed an ordinance providing for the compulsory installation of a speed governor and register on all motor vehicles operating within the capital. The speed governor, which is a local invention, and the recorder cost about 200 pesos, and if the law is enforced it will mean an additional outlay on the part of motor vehicle owners of 3,000,000 pesos a year. Widespread opposition to the ordinance has postponed its enforcement to June 4. In the interim the council has promised to reconsider the whole question.

Testing Leather Substitutes and Top Materials*

Development of Leather Cloths — Need for Standard Specifications and Test Methods — Classifications—Government Test Methods

THERE was presented on these pages in the last issue a description of the new fabric body which was prominently displayed during the week of the great National Automobile Show in New York. It will be recalled that this provided one of the sensations of show week, and that the industry was agreed that it represented the greatest future possibilities. One of the remarkable claims made for the body was that it was stronger than an all-wood or metal panelled body. This latter claim gives great importance to the subject of strength of leather substitutes for that body was covered with a leather substitute, and was in fact, put forward by the largest maker of such goods.

In view of this importance of the subject, there is presented herewith, practically verbatim, an address on this subject delivered before the body engineers' section of the Society of Automotive Engineers by a representative of the company making the fabric.

For thousands of years man has found various means for protecting himself against the elements. From the earliest Egyptian and East Indian potentates, with their gorgeous silk canopies, to the present-day man who rides in his own motor car, weather protective mediums have been in use.

In the orient, particularly, the Chinese and Japanese provided themselves with weather protective agencies in the form of waterproofed cloths, silks and papers, which for many centuries, have been manufactured largely by hand. They are now calling on the United States to supply them with a black leather cloth for the collapsible tops used on the man-drawn two-wheeled "rickshaw," as well as for a small output in auto bodies.

The first leather cloths of any value were manufactured in England early in 1800, and were used principally for hoods on perambulators, as they still are used today. Leather cloths were first manufactured in this country about 1850.

In the early stages of the development of the manufacture of leather cloth, a few hundred yards a day were considered big production, while today the material is manufactured at the rate of millions of yards a year for the automobile industry alone.

Several of our well-known automobile companies, 20 years ago, were manufacturing fine carriages, coaches and buggies, on which leather cloth was used as tops, curtains, upholstery, storm-aprons and dashboards. Leather cloth then was specially designed and constructed for the special purpose needed, the same as it is today.

With the first commercial production of motor cars, in early 1900, the problem of weather protection came under consideration, and it was most natural that the leather cloth products that had proved satisfactory for carriages should be adapted to the early automobile, and so we find grandfather's buggy-top becoming the one-man collapsible top. Some of you may remember the late carriage, with a dashboard and whip-socket made of patent leather finish leather cloth.

As the automobile industry grew, both in volume and quality refinements through the various stages of its development, so with it grew the volume of production and quality refinements of leather cloth.

Present Stage in the Development of Leather Cloth

The enormous automobile industry, in 1922, manufactured over 2,500,000 passenger and utility cars and motor trucks, consuming approximately 50,000,000 yards of leather cloth. It is being used in various qualities for approximately 20 separate and distinct uses in the construction and equipping of motor car bodies.

A few of these uses are listed as follows: One-man collapsible tops (usually requiring three men and a pinched finger for closing), curtains, upholstery, linings, gimps, welting, trunk covers and linings, mud flaps, spring covers and covers and curtains on truck cabs, etc.

In the last few years the patent-leather finish has been largely used in the construction of closed car bodies. This retains all of the good features of a metal-covered body, retaining the full curved contour and overcomes many of its disadvantages, not the least of which is initial cost of working and finishing. You have probably all had patent-leather shoes forced on you on some occasion and have noted their remarkable resistance to scratching. The non-scratchable quality of patent-leather finishes has many advantages over painted and varnished steel surfaces when applied to body construction.

Need for Specifications and Test Methods for Leather Cloths

Let us leave for a moment the possibilities of the newer applications of leather cloths to closed car construction and consider the relative importance of leather cloth in present body construction and tops for open models.

Nothing can add to or detract more from the beautiful, lustrous finish that you obtain on your bodies than a shabby, baggy, faded and dead, dull collapsible top. It may have looked well when shipped, but it possibly had a short life under weather conditions. Many of you probably have scratched your heads after having a final look at your new baby just out of the finishing department and wondered, "How's she going to look six months from now."

We all like to impress our friends and neighbors with our good judgment in buying a new car. Our reputation, however, as a good purchaser depends not only on its original lustrous appearance as we drive up in front of our home on a fine April morning, but rather move on its ability to retain that apparent newness through the biting sun and dust of July and August, the snow, sleet and cold of the winter months, and the high winds and driving rains of March, and also in certain localities the destroying effects of alkali sands and winds.

Many of you, no doubt, have watched a string of cars being driven up the main thoroughfare of any large city, and have noted the dead, dull appearance of so many tops on cars, obviously only a few months old. You may be

* Paper read at annual meeting, body section, S. A. E., New York, Jan., 1923, by J. B. Davis, Standard Textile Products Co.

assured by this sign that a disintegrating process has set in and the material has begun to fail. Obviously this condition is noticed by the owner and his friends, and it is a subject for unfriendly comment, which in no way satisfies your pride in your job.

The enormous growth in the application of leather cloth to motor car bodies places it in prominence among all other materials, the requirements for which are being daily studied, specified and tested.

The Society of Automotive Engineers has made remarkable strides in standardizing automobile parts and materials, having covered some 250 items since its inception in 1910. In carrying out your commendable program of standardization, specifying and testing of materials, you have established within your plants well-equipped chemical and physical laboratories for scientifically testing materials entering motor car construction.

Would you not desire, under your many responsibilities, and is it not logical to adopt, a uniform and scientific test and specify on these tests on your large consumption of leather substitutes, products which add so much to the original appearance of your car and the continued satisfaction of the owner in its continued service and permanency of appearance?

There are a great many makes of leather substitutes on the market to choose from, none of which may be perfect. You cannot see and figure their comparative qualities, nor their life, durability and service, nor can you match all the various quality characteristics one against the other, judging which products possess that proper balance of qualities that will best meet your requirements. But a proper standardized test would place you in a position to distinguish the advantage of each and measure numerically the more important quality characteristics of any leather substitutes that you may be considering to specify for any particular purpose.

Classification of Kinds of Leather Cloth

In leather cloth, both single and double texture, as used in the manufacture of motor cars, both in the pleasure and business types, can be clearly defined, segregated and recognized under certain general classes, depending on the purpose for which it is to be used, and the inherent scientific quality characteristics resulting from the class of materials used in their construction and the method of manufacture. Each of these classes have their particular usefulness to fulfill in motor car construction.

We have not the time, nor is it within our province, today, to describe the process of manufacture of the above classes. Each has its advantages and disadvantages, depending upon the uses to which it is put. The construction of the cloth used as a foundation, the dyeing of the cloth and the coatings applied, all have a bearing on its successful application. The problem of selecting a suitable leather cloth is almost as difficult as making it. As users, you are interested, first, in the quality, and, in the second place, the price, although on account of the small yardage per job the price is of the least importance. In the last analysis, you want a product that will meet the requirements called for on the job you turn out. The two leading attributes from your point of view likely are durability and appearance. In arriving at these two necessary attributes, the responsibility of the maker is as great as that of the user. Each should have a plan and a scientifically arranged scheme for testing these products; it would be of great advantage if there were a regularly adopted method, for many instances have occurred where, through the lack of a proper scientific test, good products have lost out, and by the same token some few poor products have temporarily won out, usually to the ultimate loss of the user.

I have been asked to address you this afternoon on the subject of testing leather substitutes and top materials. I will demonstrate the method adopted by the company your speaker represents, in the hope that you may find something of advantage, and that it may prove to be a step toward a more satisfactory and a better standardized method of testing materials in which your industry and many others are largely interested.

We will, therefore, show you, with the aid of a few slides and charts of testing equipment, and their utilization for measuring numerically their many qualities and try to put you in a position to interpret these readings into terms of durability and permanency of appearance. The general comparative appearance, with regard to luster, smoothness, softness, finish and color, you are well able to judge and interpret for yourselves in comparison with standard samples.

Method for Testing Quality of Leather Cloth

For many years we have felt the need for getting away from hand-testing and guessing as a basis for sound judgment in the testing of leather cloths. Many of you recall the old methods of determining the durability of top materials.

Many years ago it was somewhat general practice to set up in some nearby deserted cornfield a group of discarded top frames, on which were stretched the various materials for comparative tests under actual weather conditions, opening and closing the tops from time to time. This necessitated a loss of time from six months to a year. This method does not serve in these days, when decisions must be made and volume production must be had with the shortest delay possible, to meet the rapidly changing market conditions. Let us leave all antiquated methods behind us, and adopt scientific and up-to-date testing methods, which tell us the same story in a fraction of the time.

I present for your consideration the quality test methods for leather cloth products that have been developed by our own staff in co-operation with those of the government Bureau of Standards.

The Tests in Detail

1. Composition.

The serviceability of automotive leather cloths, when subjected to different uses, depends not only upon the raw materials, but also upon the manufacturing processes through which the goods were placed. Therefore, an ultimate chemical analysis will, as a rule, not be as indicative of quality as those physical tests which represent the type of stresses to which the goods are subjected in actual use. The nature and construction of the fabric is of some importance, however, for example, a very heavy fabric would not be suited for use on side curtains, which are generally folded or rolled up and tucked away under the seat of the automobile.

On the other hand, upholstery material, which is stretched and nailed and later subjected to very severe usage, must be made from very rigid fabrics which cannot easily be pulled out of shape or torn. Therefore, the particular requirements will determine whether it is most desirable to use a muslin, drill, twill, sateen, moleskin or

duck, and their suitability is judged by the weave, construction, thread count, weight, etc. These points may readily be ascertained by the ordinary methods of fabric analysis.

2. Weight.

This is one of the most important physical characteristics and is easily determined by weighing a definite length (such as 12 yards) on a factory scale. The procedure may be carried out in the laboratory as follows:

Samples are carefully chopped out with a 3 x 3 inch die. These are weighed to centigrams on a torsion balance, and the weight in the desired units of the desired area is calculated. For example, the weight in grams multiplied by the factor, 5.08, gives ounces per square yard. Ounces per square yard times the factor 1.04 gives pounds per pieces 50 inches wide. The test is made under standard conditions of 65 percent relative humidity and a temperature of 70 deg. F.

The uniformity of quality is in a considerable measure dependent upon the uniformity of weight. This does not necessarily mean that greater durability may be expected from very heavy materials. There appears to be a feasible limit each way, and extreme "body" is almost as bad as extreme flimsiness. In your efforts to secure a uniform product, you will certainly find it desirable to establish a standard weight and provide for a reasonable degree of tolerance for each class of material. Conformance to standard weight will result in greater uniformity of strength and wearing qualities.

3. Resistance to wear—(slide shown).

The severe usage which upholstery material must withstand in its constant rubbing action against the clothing very soon tells its own story on cheap material. The coating is soon worn away, peels off, and shows the bare fabric, which is of itself very little wear resistance. In view of the fact that the material is placed under some degree of tension before it is nailed to the seat frame, the wearing qualities will be greatly reduced unless the coating is made from a very durable film. The abrasion machine was designed so as to reproduce as nearly as possible in the laboratory the exact type of punishment the goods would receive on a car. The method recommended is as follows:

Strips 30 inches long and 1 inch wide are fixed within the jaws of the abrasion machine at such tension as to raise the weights just off the supports while the machine is in operation. The most suitable wearing surface is a fresh piece of muslin having a thread count of about 60 x 60. Tension is adjusted during operation to take up stretch. The number of rubs is recorded upon a small counter attached in the machine. After 1,000 rubs, and again after 2,000 rubs recorded by the count attachment, the goods are examined, and at 2,500 to 3,000 rubs the sample is removed. The test may be prolonged for special purposes. We have examined some samples on which the coating was very badly worn down at 500 rubs and removed so that the fabric showed through at 1,000. On the other hand, some materials are so durable that three or four thousand rubs are required to produce any noticeable effect. This test also indicates the resistance on top material to abrasive action. We consider this a very important test of leather cloth on account of the direct indication of hardness of coatings, which therefore, foretells wear.

4. Tensile strength—(slide shown).

It is important that the goods possess sufficient strength and rigidity to withstand the normal wear and tear of service. Limiting requirements should be adopted for each class of material. High tensile strength is necessary for working and hard usage of leather cloths, indicating great resistance to tearing or breaking under service strains. Good grades of leather cloth, if properly constructed, generally run higher than equal grades of leather. The method recommended is as follows:

The "grab" method should be used. Strips are cut parallel to the warp and filling threads 4 inches long and 1¼ inches wide. The jaws of the machine are set 1 inch apart with a 1-inch clamp. The speed of the lower jaw is regulated to 12 inches per minute, and an average of at least three breaks is obtained.

Variation of Tensile Strength of Automotive Goods

This slide (slide shown) shows the high and low points of a large number of samples examined in our laboratory, and indicates the variation that may be expected from the different commercial brands. If you desire a very strong material which cannot easily be ripped from the bows, you must subject it to a scientific test which will determine its suitability.

5. Bonding strength—(slide shown).

In order to produce a piece of goods with a very even coating which will appear thready when stretched, and at the same time to increase the strength and water resistance, and overcome diagonal stretch due to construction of sateens and twills base fabrics, some manufacturers follow the practice of cementing two fabrics together before laying on the coating. In these cases it is quite important that the cement be very strong, so that the plies will not separate when stretched over the bows of the auto top. The separation of the plies results in general weakness and greatly reduces the resistance to water. The degree of adhesion between the two fabrics may be conveniently determined by an attachment to the Scott dynamometer.

The method recommended is as follows:

Strips are taken 8 in. long and 1 in. wide out parallel to the threads either in the warp or filling direction. Separation of the plies is started with a knife and they are stripped back about two inches. One end is fixed in the upper jaw and the other in the lower jaw. The motion of the lower jaw of the dynamometer continues the separation at uniform speed of 12 in. per minute. The tension required is shown by the balance dial. This must be watched during the separation. It will be found that the pointer is approximately steady about an average point. Tearing of threads must be avoided by proper cutting of sample. For example: the pointer might vary from 2 pounds 6 ounces up to 2 pounds 10 ounces, in which case we would call the bonding strength 2½ pounds per inch.

Bonding Test Strips

The slide (slide shown) indicates the nature of the strips used in the test and their appearance after separation.

6. Resistance to stretch—(slide shown).

You have all seen baggy tops on cars flapping in the wind, sagging and losing their trim appearance. Tendencies toward this condition can be foretold by measuring the percent elongation under tension. This is accomplished by means of an autograph attachment to the fabric

dynamometer. The method of testing recommended is as follows:

The jaws of the dynamometer are fixed 3 in. apart with the 1¼ in. clamps in place. The stretch is measured by actual distance about the base line on the stretch-strain diagram, and is recorded at 20 pounds, 40 pounds and 60 pounds. (Samples are taken 6 in. long and 1 in. wide.)

Autographic Stretch Diagram

This slide (slide shown) shows the stretch diagram obtained on two different samples of automotive top materials. In the one case, the stretch is very high, amounting to about 9 percent in the warp direction at 60 pounds; whereas, in the other case, the stretch is less than half that amount. The test is, of course, very severe and it is not to be supposed that an auto top would ever be subjected to a force sufficient to stretch it 9 percent. However, the figures obtained are relative, and it has been shown that the 9 percent material in actual service is less satisfactory than the 4 percent material.

7. Resistance to puncture—(slide shown).

This test represents the resistance to puncture by any sharp object. It is determined by means of a small, steel foot, which is pressed against the fabric and the force measured which is necessary to produce rupture. The test recommended is as follows:

The Webb tester is fitted with the ⅛ in. foot, which is used over the No. 1 hole. The goods are placed under the foot and held by means of a clasp in both the warp and filling directions while the pressure required to puncture the goods is recorded. Incidentally, this instrument was originally designed to measure the breaking strength of paper and strawboard, but various attachments which have been supplied with the device have made it suitable for measuring some of the qualities of leather cloth. A flat 1 in. square foot, which is furnished, may be used to measure resistance to crack. However, it is not possible to obtain pressure as high on the water tester, which I will show you in a few minutes.

8. Thickness.

You will note alongside of Webb tester an Ashcroft thickness gauge, style X, used for determining thickness of leather cloths (slide shown).

9. Toughness of coating—(slide shown).

The operations of folding and stitching will produce large cracks on an inferior material; whereas, a high-grade product will withstand severe manipulation without injury. In order to determine the relative resistance to cracking this apparatus was devised. This instrument measures crack pressures up to 100 pounds per square inch, but many high-grade leather cloths will easily withstand this. We have, however, examined a few products which were so brittle as to crack below one pound, obviously much too low to meet even the simplest manufacturing requirements. The test recommended is as follows:

Strips 1 in. wide are cut parallel to the warp and filling of the base fabrics. These are folded over into creases with coatings up and placed beneath the foot of the tester. Pressure on the spot is gradually increased by rotation of a hand wheel until the coating cracks. The pressure is recorded by the use of a diaphram filled with water and connected with pressure gauge.

Toughness of coating is also sometimes determined in a practical way by manipulating the goods between the fingers, in which is commonly called the "scrub test." There are a number of other so-called "hand tests" which are sometimes used as a general guide. One of these consists of drawing some blunt instrument quickly across the under surface; another is to fold the goods double and rapidly draw them apart. These tests are of course, no more than general indication, as different persons do not perform them in the same way.

10. Adhesion of coating—(slide shown).

Very often when you observe the upholstery of cheap cars, which have been on the road for a little while, you see that the coating has peeled off in large pieces, showing the fabric beneath. In fact, the coating on some materials is anchored so poorly that it may be easily pulled off with the finger nail. In a practical way, a general idea of the degree of adhesion may be obtained with the finger nail test, as mentioned above. However, the test is far from exact, and, of course, does not permit the expression in numerical units. We have, therefore, designed an attachment to our crack tester to measure this properly and recommend the following:

One-inch strips of the goods to be tested are cut parallel to the warp and filling threads. Near one end of each of these a flat S-bend is formed. One pound pressure is then applied on the bend by the pressure jaws. The ends are fastened to a clip on the motor-driven revolving cylinder. The motion of the cylinder draws out the goods at a uniform speed. Various pressures are used until minimum pressures, at which the coating is stripped from the base, is determined.

11. Resistance to water—(slide shown).

The importance of affording protection from rain is quite obvious in the case of topping and deck material.

The relative resistance of various leather cloths may be determined as follows:

A sample of the coated goods is placed face down in the Mullen tester (the rubber diaphram should first be removed and the well filled with water) and the pressure determined which is necessary to force the water through.

Materials which have a very low degree of water resistance may be tested as follows:

A piece of goods 20 x 20 inches is folded into a bag partially filled with heavy objects of irregular outline and immersed in water as far as possible. Penetration after 24 hours and again after 48 hours is noted. (Lights.)

12. Resistance to shrinkage.

Several instances have come to our attention in which auto tops shrunk so badly as to pull the bows out of shape and loose from the frame. The shrinkage factor should, therefore, be predetermined as follows:

Lines are ruled 10 inches on the sample to be tested. It is then soaked in water at room temperature for one hour, drained and hung up vertically to dry. After it is completely dry, the distance between the lines is measured and the contraction expressed in percentages.

13. Resistance to fire.

It is, of course, not possible by any "hokus pokus" process to convert cotton, or, in fact, any organic substance, into asbestos. However, it is desirable that the coating materials should not be highly inflammable. The relative fire resistance can be determined as follows:

Strips are cut 1 in. wide by 8 in. long and supported vertically so as to hang freely. One of the lower corners is ignited with a match and time determined from application of match to complete combustion of the strip. This

(Continued on Page 28)

Motor Vehicle Exports in 1922 Double Those of 1921

MORE than 78,000 passenger cars and motor trucks, twice as many as in 1921, were exported from the United States during 1922, according to compilations made by M. H. Hoepli, acting chief of the automotive division of the Department of Commerce. Besides these exports over 15,000 motorcycles were shipped overseas during the year, over 4,000 more than in 1921. The figures for passenger cars and trucks, with comparisons by years from and including 1913, are:

	—Passenger Cars—		—Trucks—		—Parts—
Year	No.	Value	No.	Value	Value
1913..	25,880	$25,343,644	1,009	$ 1,686,807	$ 6,270,116
1918..	36,936	36,278,292	10,308	26,814,952	33,607,050
1919..	67,145	73,700,527	15,585	35,425,437	42,562,186
1920..	142,508	165,255,921	29,136	46,775,781	86,198,013
1921..	30,950	32,533,725	7,480	10,335,893	39,058,729
1922..	66,790	51,049,616	11,445	8,270,908	38,298,032

The relative decrease in values hardly calls for an explanation in view of the well-known downward movement in car and truck prices, practically all through the year. These price reductions, however, especially in the case of passenger cars, prove an important factor in our foreign sales. American car values are greater than ever before, as with the total production at its highest our manufacturers are willing to work at a very small margin of profit. The volume of sales of the European producer, on the other hand is small and his manufacturing costs are accordingly higher. The foreign purchaser who sees the American-made car next to the European product, naturally compares values, and his conclusions are in our favor. Reports from the last London show substantiate this statement.

Trend of Exports Upward

December exports registered a decided increase and the year closed, in regard to the number of passenger cars exported, with a gain of 180 percent over January exports and 281 percent over the first month's shipments of motor trucks.

Australia, Canada and Mexico are still our best customers for passenger cars. Shipments to the four leading markets, Belgium ranking fourth on a quantity basis, account for approximately half of our total exports for complete cars and chassis. The following are the major markets in the order of number of passenger cars exported during 1922:

Leading Markets for Passenger Cars Exported from United States During 1921 and 1922

	1921 Passenger Cars		1922 Passenger Cars		
Countries	No.	Value	No.	Value	Unit Value
Australia	3,020	$3,065,909	11,236	$ 8,716,930	$ 776
Canada	5,243	7,187,865	10,214	10,569,481	1,035
Mexico	6,750	5,183,791	7,219	4,640,801	638
Belgium	533	379,193	4,785	1,836,284	384
United Kingdom	888	820,018	4,315	3,345,706	775
Sweden	920	1,039,275	3,063	1,859,961	607
Argentina	613	850,991	2,497	2,307,067	924
British So. Africa	596	687,738	2,327	2,094,687	900
Spain	421	737,030	2,117	1,810,067	855
New Zealand	691	875,552	1,840	1,551,277	843
Cuba	1,692	1,428,162	1,689	1,228,636	727
Brazil	285	418,834	1,672	1,376,552	823
Japan	1,281	983,542	1,271	783,291	616
Norway	55	67,500	1,176	496,624	422
British India	820	909,609	1,079	869,763	806
Palestine & Syria	357	160,343	899	576,578	641
Uruguay	164	297,382	772	370,150	481
Netherlands	398	427,776	688	648,612	943
China	499	532,803	572	463,815	811
Philippine Is.	467	476,484	550	457,927	833
Denmark	109	159,586	525	427,885	815
Other countries	5,048	5,844,342	6,224	4,617,522	

Notable Changes in Motor Truck Markets

While Canada, Australia, Japan, and Mexico have maintained their leading portion in the foreign markets for American motor trucks, some radical changes as illustrated below took place in our exports to Europe:

Leading Markets for Motor Trucks Exported from United States During 1921 and 1922

	—1921—		—1922—		
Countries	No.	Value	No.	Value	Unit Value
Belgium	69	$ 77,756	7,824	$ 735,650	$2,604
Canada	1,146	1,798,855	1,259	1,870,929	1,486
Australia	720	1,194,900	1,059	1,211,199	1,437
Japan	756	634,867	1,001	911,296	910
Mexico	1,482	1,554,554	983	617,085	627
Spain	27	49,952	786	207,316	264
Other S. America	252	324,314	443	268,233	606
Sweden	64	133,690	387	132,988	343
United Kingdom	277	430,310	383	381,547	996
Cuba	283	366,710	303	143,407	473
Norway	20	28,461	229	85,701	374
British Africa	93	159,653	182	230,874	1,268
Brit. E. Indies	199	432,439	117	154,509	1,321
Netherlands	300	267,932	88	51,358	577
Brazil	103	354,810	65	83,767	1,288
China	71	105,485	62	47,995	774
Argentina	24	70,111	58	68,180	1,175
Philippine Is.	234	221,650	29	31,292	1,079
Dutch E. Indies	368	922,997	9	13,906	1,545
Other countries	892		1,177	1,023,576	869

Motorcycle Exports Show Large Increase

Exporters of motorcycles also made a substantial recovery in their foreign business from the depression in 1921, when the exports of 11,001 motorcycles valued at $3,517,769 represented approximately 24½ percent of their production. Shipments abroad during 1922 totaled 15,976 machines valued at $4,028,742—an increase of 45 percent in number and 14 percent in value over exports in 1921. Although production figures are not at hand for 1922, it is estimated that the percentage exported is somewhat higher than during the previous year. Such a recovery in the face of increasing British competition following the renewed activity of the motorcycle industry in the United Kingdom, augurs well for larger export markets for the future.

The unit values of motorcycles shipped to the 20 leading markets varied from $216 in New Zealand to $283 in Switzerland. The average value of all shipments was $252 as against $319 in 1921.

Motorcycle Exports During 1921 and 1922 by Countries and Destination, with Totals for 1913, 1918 and 1919

	1921		1922		
Countries	No.	Value	No.	Value	Unit Value
Australia	803	$229,245	3,706	$893,812	241
Netherlands	1,938	614,580	2,251	605,642	269
Belgium	532	175,213	1,027	274,690	267
Italy	571	173,316	944	236,509	250
New Zealand	440	149,815	806	204,680	216
Spain	332	103,189	793	211,268	262
Japan	555	181,367	735	192,842	262
Canada	506	157,401	711	171,908	241
Denmark	582	193,828	636	165,327	259
England	567	183,132	591	147,801	250
British South Africa	455	144,089	547	135,534	247
Norway	385	133,309	456	115,600	253
Sweden	1,328	421,888	427	93,902	219

France	292	79,278	296	67,207	227
British India	213	73,901	245	60,966	248
*Java and Madura	376	124,140	239	57,090	238
Argentina	125	41,440	215	55,013	255
Switzerland	84	32,960	176	49,917	283
Mexico	99	32,442	149	49,191	269
Germany	7	2,350	144	35,420	245
Others	811	270,886	882	240,423	272

	No.	Value
Total, 1920	37,662	$10,756,580,285
Total, 1919	24,481	6,687,436,273
Total, 1918	9,212	2,169,385,235
Total, 1913	3,983	749,072,188

* Listed as Dutch East Indies in 1921.

Surprising as it may seem, the leading markets for American motorcycles are found in western and central Europe, where domestic competition is strong, and in the leading dominions of the British Empire, in most of which British machines receive tariff preferences.

With the exception of Sweden, where rather large exports were sent in 1921, every leading market took increased shipments, not taking into consideration the comparison between Java and Madura in 1922 and the Dutch East Indies in 1921. With such encouraging markets in centers where competition is strongest, it is felt that American manufacturers have bright prospects of exporting a much greater proportion of their production, and in order to assist them the automotive division recently requested special reports on all of the foreign markets, both large and small, which will be received during the current year, and will be made available to exporters as they are received.

Exports from Canada Deserve Consideration

Canadian plants, practically all of which are controlled by American capital, have shipped little less than half the number of cars exported from the United States. The ratio between America and Canadian exports, by number, has remained almost stationary for the last two years.

As the preferential tariffs between the various parts of the British Empire have played a large part in the upbuilding of the Canadian automobile industry, it is hardly surprising that the largest portion of Canada's automotive exports are directed to British territories, the leading one of which is Australia.

The chief markets are given below:

Leading Markets for Passenger Cars and Trucks Exported from Canada During 1922 and 1921

	No.	Value	No.	Value
Australia	10,867	$5,413,949	3,839	$1,680,850
United Kingdom	9,687	7,051,634	763	586,933
New Zealand	2,848	1,504,172	584	295,846
Brit. S. Africa	2,771	1,386,392	1,066	503,190
Argentina	2,105	1,350,099	166	119,023
India	1,998	915,945	936	428,049
Sweden	569	327,219	39	26,057
Dutch E. Indies	555	325,670	1,000	442,677
Spain	403	382,389	....	......
Ceylon	277	121,116	40	18,809
Brazil	248	199,022	4	1,837
Sts. Settlements	188	76,491	216	93,315
Japan	184	147,740	4	4,229
Netherlands	182	128,750	7	7,553
Norway	149	114,587	....	......
Mexico	147	156,945	4	5,329
U. S.	138	74,263	100	56,152
China	138	120,867	20	22,945
Brit. E. Africa	127	50,677	121	51,489
Uruguay	85	65,798	4	4,374

The combined shipments from the United States and Canada to Australia exceeded 22,000, and give thus a striking evidence of the possibilities in this and other territories, for the exporter of accessories and service station equipment, both of which are not given separately in the available statistics.

"Thermos Bottle" Holds Molten Iron in Ford Plant

To eliminate double heating of metal used in auto castings, the River Rouge, Mich., foundry of the Ford Motor Co. employs a container, operating on the principle of a thermos bottle, in which the molten iron, coming from the furnaces, is maintained at white hot furnace temperature until the casting room is ready for it.

The usual method has been to cast the molten iron into pigs made up of the proper chemical composition. These pigs are melted a second time whenever it is desired to make castings—a duplication that results in considerable loss of time and labor.

The new container, with capacity of 25 tons, consists of one cylindrical shell within another, the inner one being lined with firebrick. At each end is an opening, one to receive the molten metal, the other to act as a spout in pouring the castings. The low conductivity of firebrick makes it possible to keep the iron at white heat for five hours, during which time the contents can be used up for castings.

The proper chemical composition of the metal is obtained by tests of the iron in the container. Since the ore is not uniform, it is necessary to "doctor" it after smelting. Thus if it is found that a batch contains too little carbon, the metal in the container is mixed with a precise amount of cupola iron of greater carbon content. The result is the desired chemical composition. By the new method, molten metal enters one end of the container, and when wanted is poured from the other end into monorail buckets that carry it to the foundry.

Fisher Expanding National Glass

Arrangements have been completed for extending and enlarging the facilities of the National Plate Glass Co., subsidiary of Fisher Body Co., so that it will become one of the largest factories of its kind in the country. More than $5,000,000 will be spent in the program and 200 acres of ground adjoining the present plant at Ottawa, Ill., have been purchased for this purpose. The present annual capacity of the glass company is close to 30,000,000 sq. ft.

May Increase Fisher Body Stock

A special meeting of stockholders of the Fisher Body Corp. has been called for March 6, to be held at the offices of the company in New York. The meeting is for the purpose of having the stockholders approve an increase in the company's capital stock from 500,000 to 600,000 shares of no par value, previously voted by the directors, and also to approve reduction of the directorate from 14 to 11 members.

Goodyear to Pay Bonus

Goodyear Tire & Rubber Co. has announced a 10 per cent bonus for all hourly and piece work employes, starting Feb. 20. It will be given to employes having steady attendance records. P. W. Litchfield, vice president, says the bonus will continue until further notice.

Tractors on Southern Farms

By H. R. TOLLEY* and L. M. CHURCH**

Pointers for Manufacturers of Motor Tractors from the Experience of Users — Possible Demand and Future Sales

> Two or three years ago, Automotive Manufacturer published a series of articles, somewhat similar to this, which detailed the experience of western farmers with tractors. This series met with great favor, and we hope as good fortune for the present series, detailing the experiences of southern farmers. Obviously, working and climatic conditions are decidedly different in the south and west, and the present articles are in no way a repetition of what has gone before.

TRACTORS were not introduced in any great numbers in the southern states until their use had become general in other parts of the country. The crops raised, the systems of tenure under which the land is held, and the class of labor which has been generally available have all combined to retard the use of labor-saving farm machinery of all kinds in this area. Often the fields are so small or high terraces so numerous as to make difficult the use of large units of equipment.

Changing conditons during recent years, however, have led a considerable number of farmers in these states to place tractors on their farms. Many of these tractors have now been in use a sufficient length of time to enable their owners to determine the kinds of work which the tractors will do satisfactorily, the cost of operation, their effect on the operation and organization of the farms, and other points on which the man who is considering the purchase of a tractor should have information.

This bulletin summarizes the experience of 684 tractor owners in the states of Alabama, Georgia, North and South Carolina, and Tennessee. In February and March, 1921, a letter was addressed to each of several thousand men in these states who were known to own tractors asking for a report of the use which he was making of his tractor, for information from which the cost of operating the tractor could be determined, any changes in the size of the farm or number of work stock which had been made after the purchase of the tractor, the owner's idea of the profitableness of the machine, and other related information. Of the replies received all those concerning second-hand tractors, tractors which had been owned six months or less, the comparatively few which had been purchased prior to 1918, and those which were used primarily for custom work were discarded. This left reports from 81 men in Alabama, 147 in Georgia, 134 in North Carolina, 75 in South Carolina, and 247 in Tennessee who owned tractors which had been purchased new, and which were used primarily for work on their own farms.

Most of the figures given are averages from these reports, and while the tractor owner should always endeavor to exceed the average performance, he must remember that the accomplishment of approximately half the men reporting was in every case below the average figures given. At least, the average figures are better guides as to what may be expected of a tractor under actual farm conditions than are the results of tests or performances with new tractors, operated by skilled men, under favorable conditions.

Farms on Which Tractors Are Owned

The most striking point concerning the farms on which these tractors are owned is their large size as compared with other farms in the same states. The average size of the 684 farms is 290 acres, while the average size of all farms in these states, as determined by the 1920 census of agriculture, is only about 75 acres.

The average size of the farms where tractors are owned, and of all farms in the different states are as follows:

Table 1—Average Size of Southern Farms Using Tractors

States	Farms on which tractors are owned. Acres	All farms (1920 census). Acres
Alabama	344	76
Georgia	318	82
North Carolina	205	74
South Carolina	315	64
Tennessee	293	77

The size of the farms in the different states from which reports were received are shown in Table 2. Thirty-five tractor owners failed to state the number of acres in their farms.

Table 2—Size and Number of Farms of Different Sizes Using Tractors

Size of farm (acres)	Number of farms— Alabama	Georgia	N. Carolina	S. Carolina	Tennessee	Total
Less than 75	6	4	19	6	8	43
75 to 174	27	53	51	25	65	221
175 to 274	15	37	31	18	68	169
275 to 374	7	11	9	8	41	76
375 to 574	11	19	10	5	34	79
575 and over	9	18	5	8	21	61

It is seen that more than 90 percent of the farms on which tractors were owned are larger than the farms of average size in this section.

On most of the farms corn and cotton were the principal crops raised, but the proportion of the acreage devoted to these crops was slightly less than on all farms in these states as shown by the 1920 census of agriculture. On the Alabama, North Carolina, and Tennessee farms where tractors were owned, corn occupied a greater acreage than any other crop. In Georgia corn and cotton occupied the same acreage, and in South Carolina the acreage in cotton was considerably greater.

Table 3 shows the average number of crop-acres per farm and the proportion of this acreage devoted to different crops. A detailed report concerning the crops

* Agricultural engineer.
** Assistant in agricultural engineering, Bureau of Public Roads.
Taken practically verbatim from Farmers' Bulletin 1278.

raised on his farm was not furnished by every tractor owner, but it is believed that the figures in the table are very nearly representative of the entire group.

Table 3—Proportion of Acreage Devoted to Different Crops

States	Average crop area	Proportion of acreage				
		Corn	Cotton	Hay	Small grain	Other crops
	Acres	Pct.	Pct.	Pct.	Pct.	Pct.
Alabama	240	34	25	21	10	10
Georgia	255	32	31	9	15	13
North Carolina	147	28	19	16	24	13
South Carolina	238	26	44	10	15	5
Tennessee	197	36	5	25	22	12

Sizes of Tractors

Five hundred and twenty-four, or 76 percent, of the 684 men own 2-plow tractors, and 135, or 20 percent, own 3-plow machines. Thirteen men own the 1-plow size and 12 the 4-plow size. The number of tractors other than the 2-plow and 3-plow sizes is so small that in the following pages figures for only the two sizes are given.

The number of tractors of different sizes in the different states concerning which reports were received is shown in Table 4:

Table 4—Number of Tractors of Different Sizes

States	1-plow	2-plow	3-plow	4-plow
Alabama	1	62	15	3
Georgia	..	123	21	3
North Carolina	1	112	21	..
South Carolina	..	50	24	1
Tennessee	11	177	54	5
Total	13	524	135	12

In general, the 2-plow tractors are used on smaller farms than are the 3-plow machines, the average size of all farms on which the 2-plow tractors are owned being 262 acres, and where the 3-plow machines are owned 402 acres. Two-plow machines are owned on 82 percent of the farms less than 175 acres in size, and on 73 percent of the farms 175 acres and larger in size.

Advantages and Disadvantages

There are certain advantages connected with the use of a tractor, and certain disadvantages. Just how great the different advantages and disadvantages are, however, and which ones should be given the greatest weight when endeavoring to decide whether or not to purchase a tractor are questions which a man who has not had experience with a machine can not answer. Each of these tractor owners was asked what he had found to be the greatest advantage of his tractor, and what he had found to be the greatest disadvantage. The answers are summarized below.

ADVANTAGES

Saving Time and Labor

A little over 400 men stated what they believed to be the greatest advantage, and nearly 50 percent of them consider it to be the saving of time and labor effected by the tractor. The ability of the tractor to do a large amount of work in a short time, and the opportunity which it affords to perform field operations at the most opportune time, is considered to be the greatest advantage by a majority of the tractor owners not only in the south, but also in other sections of the country, and it seems that most farmers should give this advantage the greatest weight when deciding whether or not to purchase a machine.

Where the organization of the farm and the method of employing labor are such that hired labor, which would be necessary if the tractor were not used, can be dispensed with a considerable saving in expense for this item should result.

Better Work

After saving of time, the fact that the tractor does better work than can be done with horses and mules was cited most frequently as its greatest advantage by these southern farmers. Deeper and better plowing and better preparation of the land after plowing, are often possible with the heavier tractor-drawn implements and the greater amount of power furnished by the tractor. This higher quality of work which can often be done at a more opportune time than would be possible with horses or mules is a valuable aid in securing maximum crop yields.

Relieving the work stock of hard work, especially in hot weather, and doing the work at a time when it would be difficult if not impossible with horses and mules, was given as the greatest advantage of the tractor by about one-tenth of the owners.

Reduction of Expense

Less than 5 percent of the users consider that reduction of expense is the greatest advantage of the tractor. This, together with the fact that the cost of operation is given most often as the chief disadvantage connected with the use of a tractor, indicates that the introduction of a tractor will not often reduce to any great extent the expense of operating the farm.

The fact that the tractor is a convenient source of power for belt work was mentioned by approximately 15 percent of these men as its greatest advantage. If there is a large amount of heavy belt work for which a tractor could be used satisfactorily, its ability to do such work in addition to drawbar work may be the deciding factor in determining whether or not one would be profitable.

DISADVANTAGES

Cost of Operation

The cost of operation, more than any other point, was emphasized as the great disadvantage of the tractor by these men. Some mentioned specifically the high cost of fuel and oil as compared with the low prices of farm products at the time their reports were made. Others stated that repair costs had been excessive, and others gave first importance to the depreciation of their machines.

Next after cost of operation the lack of adaptability of the present-day tractor to do all the work on southern farms is considered the greatest disadvantage. While the tractors owned by these men are especially well adapted to plowing and other heavy work of preparing the seed bed where fields are large and comparatively level, most of the machines can not be used satisfactorily for cultivating row crops; many of the owners stated that they could not use their machines with entire satisfaction in small or irregular-shaped fields; and others emphasized the difficulty of using their tractors on land which had been terraced.

Mechanical Trouble

While mechanical trouble was not mentioned as often as the disadvantages listed above, a sufficient number mentioned mechanical difficulties and the lack of reliability as the principal disadvantage to warrant a warning to the prospective purchaser that he should be sure the machine he buys has proved reliable in the hands of other farmers.

It is probable that in many cases the mechanical difficulties are due at least in part to lack of ability on the part of the operator of the machine.

Probably a greater percentage of the tractor owners in the south than in other sections of the country depend upon hired help to operate their tractors, and such men often find it difficult to obtain competent operators. If a man who does not operate his own tractor can not find a reliable operator, repairs are likely to be high, and the machine may be out of order to such an extent that all the advantages connected with its use are overcome.

Are These Tractors Profitable?

The method of conducting the investigation was such that it was not feasible to obtain a detailed statement from each tractor owner as to the extent to which the cost of power and labor for operating his farm had been changed through the use of the tractor, but each farmer was asked whether or not he believed his machine would prove to be a profitable investment, with the thought that replies to this question would give a good indication as to the profitableness of tractors in general. Eighty-six percent stated that they believed their tractors were proving profitable.

A comparison of the reports of the men who were satisfied with their tractors with those from men who were dissatisfied that in some cases the failure to take advantage of the opportunity offered by the tractors to increase the acreage cultivated and reduce the number of work stock kept was probably responsible for the dissatisfaction; in other cases high operating costs or the poor service rendered by the tractor was responsible. Experience has shown over half the dissatisfied owners that their present tractors are not the proper size for their farms.

These reports were made in the spring of 1921 at a time when the prospects for a profitable crop year were not at all promising, and in order to determine whether these men were sufficiently well satisfied with their machines to use them in producing crops on which the profits would probably be very small they were asked wether they intended to use their machines during the season of 1921. Exactly 90 percent replied that they would do so. Ninety-six percent of those who believed their tractors would be profitable stated that they intended to use them in 1921, and only 52 percent of those who did not believe they would prove profitable intended to use them that year.

The Best Size

It is highly important that the tractor be of the proper size for the farm on which it is to be used and the work which it will be expected to do. A tractor owner may feel that his present machine will be profitable even though experience has led him to believe that some other size would be better for his conditions.

Six hundred and eleven of the 648 men reported the sizes which they now consider would be best for their farms, after having had experience with tractors, and 98, or 16 percent of the total, now prefer sizes different from the ones they own. There had evidently been a tendency on the part of some to purchase machines which were too small for their needs, as only 16 of the 98 prefer smaller machines, while 82 prefer tractors larger than they now own.

Eighty-four percent of those who own 2-plow tractors still prefer this size and 14 percent prefer the 3-plow size. Eighty-eight percent of those owning the 3-plow size still prefer it, while 8 percent prefer the 2-plow size. Of the 611 who answered this question 12 prefer the 1-plow size, 404 the 2-plow, 176 the 3-plow, and 19 the 4-plow size or larger. (See title-page.) Thus, it would seem that, except under extraordinary conditions, a tractor for use in these states should be either the 2 or 3 plow size.

Is the Farm Large Enough?

The question as to whether a particular farm is large enough to warrant the purchase of a tractor is also important. In order to obtain information which would assist in answering this inquiry these experienced tractor owners were asked what they considered the smallest size of farm on which the tractors the size of theirs could be used profitably.

Of course the organization, as well as the size, of a particular farm must be known in detail before one can say definitely whether a tractor would be profitable, but the opinions of these experienced men should be a general guide as to the minimum size of farm on which tractors of the kind and size they now own might be used profitably.

The average of the replies of the owners of the 2-plow machines was 92 acres and of the owners of the 3-plow machines was 132 acres. In each case the replies of something like half of the men were above this average figure and the remainder below it.

It would seem that the man whose farm is much less than 90 acres in size would not be warranted in purchasing a 2-plow machine if he intended to use it primarily on his own place, nor would one whose farm was much less than 130 acres in size be warranted in purchasing a 3-plow machine. It must be remembered that the average sizes of the farms being operated were considerably larger than these figures, namely 262 acres for the 2-plow tractors and 402 acres for the 3-plow machines.

(To Be Concluded)

S. A. E. Meeting Plans for 1923

Announcements regarding their meeting for the year have been made public by the Society of Automotive Engineers. Prominent among these is the decision to hold the Spring Lake, N. J., gathering June 19 to 23, inclusive. The next annual meeting will be held at Detroit some time in January, 1924. This change in plans is made to avoid numerous conflicts resulting from the practice of holding the annual affair during the week of the national automobile show in New York.

A meeting of the S. A. E. will be held in Cleveland April 26 to 28 devoted to automotive transportation. This will include sessions on operation and maintenance of the motor truck, motor bus, taxicab and motor rail-cars. The production meeting will be held in Cleveland the latter part of October, according to present plans.

Steel Wheels Becoming Prominent

Prominent men in the wheel industry predict that fully 20 percent of all cars manufactured in 1923, excepting Fords, will have steel wheels as standard equipment. C. C Carlton, secretary of the Motor Wheel Corp., pointed out that the first 50 automobile manufacturers, whose output comprises the bulk of the industry's production, 16 list steel wheels as standard equipment on one or more models, 24 more schedule them as optional equipment, while only 10 omit entirely.

Testing Leather Substitutes and Top Materials

(Continued from Page 22)

includes time intervals for ignition as well as combustion. The condition of the cinder and rapidity of travel of the flame are noted.

14. Resistance to heat.

There is a considerable variation among the numerous commercial brands of leather cloths in their properties of heat resistance. Some are almost unaffected by summer heat, whereas, others "sweat" very badly when slightly warmed. This "sweating" or "spewing" is a very objectionable characteristic in leather cloth. We recommend the following test:

The samples should be placed within a constant temperature oven adjusted to 150 deg. F., and allowed to remain for a period of two hours, after which they are examined for tackiness and sweating. They are then allowed to come to room temperature and are examined for change in flexibility and permanent change in toughness.

15. Cleansability and resistance to gasoline.

In order to determine the ease with which the coating can be cleaned it should be subjected to a practical test by washing small strips with soap and water and also with gasoline. There should be no appreciable loss of luster or injury to the coating. An alternative test in the case of laminated leather cloth, or the two-ply khaki top material, used largely for sport tops, an alternative method is to soak in gasoline for twenty-four hours and dry, after which no difference should be found from the original sample, whether in bonding or in tensile strength.

16. Natural and artificial ageing—(slide shown).

The final real criterion of quality is "How do the goods stand up in service?" It is a very long time to wait for goods to deteriorate under the natural influence of sunlight, wind, snow, rain, etc. In order to determine quickly the relative merits of various fabrics, it is possible to expose the samples to the ultra-violet rays of a mercury arc light.

By means of the mercury arc light we can obtain information in a few days which would ordinarily require several months, showing both deterioration of coating as well as the stability of color of composite cloths. Some time ago, we conducted an outside exposure test on practically all of the leather substitutes on the market.

(Three slides were shown at this point, illustrating the effects of exposure on water resistance; on flexibility; on the toughness of the surface coating. Other slides illustrated various qualities in leather cloth coatings.)

You have seen the numerous properties which show wide variation among the different brands. In order to guard against these fluctuations so that goods may be produced uniformly high in quality, it is necessary that the manufacturers take great precautions throughout the various stages of the process to insure against defects in the finished material.

In the case of the untreated raw material, the quality is insured by chemical analysis and the uniformity of the treated products maintained by careful control of the chemical and physical properities. This instrument (slide shown) has been modified within our company to meet our own particular requirements. The viscosity is determined by measuring the friction resistance between the oil and a brass spindle.

The strength, elasticity and wearing qualities of leather cloths are dependent to a considerable extent upon the character of the skin forming material with which they have been coated. In order to obtain strength without sacrificing pilability, it is necessary to maintain the proper balance between the fabric and the coatings. The fabric must be chosen to furnish the necessary tensile strength and knowing the weave construction, weight, etc., the coating materials may then be scientifically selected to yield the most serviceable products.

Pigments and Fillers

The skins formed from various coating vehicles do not in themselves possess the desired characteristics of strength and wearing qualities. In order to increase the resistance to wear, and at the same time meet the artistic requirements or color and finish, certain pigments must be incorporated into the mixture. These are purchases on specifications, and carefully checked for uniformity.

Out of your desire to produce motor cars with all features of design and construction carefully balanced, so as to give the purchaser the maximum that he may reasonably expect for his money, you have adopted definite specifications for many of the mechanical parts. The steel used must conform to definite requirements; the instruments must all meet certain tests, and yet very few of you have adopted the practice of purchasing your leather substitute requirements according to any agreed specification of quality.

In cooperation with some of the motor car and body manufacturers, we have been able to assist them in the preparation of their specifications, and I believe that the motor car manufacturers in general, as well as the numerous manufacturers of leather substitutes of all types, will be markedly benefited by a more universal adoption of this procedure.

General Motors Buys Milburn Plant

General Motors Corp. recently absorbed the Milburn Wagon Co. plant at Toledo. The price is understood to have been $2,000,000 and the purchase includes 20 acres of land with somewhat extensive lumber yard. It is said that the purchase was made in connection with the working agreement in effect between General Motors and the Fisher Body Co. Future developments at that point do not contemplate the building of bodies unless the Fisher Co. should find it necessary to use these facilities for increasing its capacity.

The deal leaves the Milburn Co. free to devote its attention to the development of its electric automobiles business. The plant was at one time one of the greatest wagon factories in the world but this industry has lately been subordinated to that of making automobile bodies. With ample funds for such development, the Milburn electric manufacturing business is to be expanded extensively, it is declared.

Durant Buys Glass Works

It is reported that W. C. Durant has taken over the entire capital stock of the American Plate Glass Co., Kane, Pa. The company is credited with an annual capacity of approximately 6,000,000 sq. ft. of plate glass, an amount sufficient to meet all the requirements of the Durant group. The transaction, it is said, has been financed privately, but present holders of Durant securities are expected to be offered stock in the concern.

New Caution Plate Adopted for Truck Use

The National Automobile Chamber of Commerce motor truck committee has adopted a new caution plate which is the outgrowth of investigations and recommendations made by sub-committees of the Society of Automotive Engineers and the truck standards committee, working jointly and in cooperation with the motor vehicle commissioners of 10 eastern states, including New England, New York, New Jersey, Pennsylvania and Maryland. The N. A. C. C. motor truck committee strongly urges that all trucks carry the new plates, a facsimile of which is presented herewith.

The caution plate is recommended to be etched on 16 B. & S. gauge rolled brass, with the letters recessed and filled with red and black enamel. The center of the plate may be used by the manufacturer for model designations, size or tonnage rating of the chassis, if it is found desirable. The following are the recommendations adopted by the truckmaking members of the N. A. C. C.

The figures given in the following table should be recognized bv the manufacturer as the maximum and not exceeded under and condition.

Gross Weight, Chassis, Body and Freight Load	Speed Miles per Hour
Pneumatic tires up to 28 lb.	25
Solid rubber tires, up to 4,000 lb.	25
Solid rubber tires, up to 8,000 lb.	20
Solid rubber tires, up to 12,000 lb.	18
Solid rubber tires, up to 16,000 lb.	16
Solid rubber tires, up to 20,000 lb.	15
Solid rubber tires, up to 24,000 lb.	15
Solid rubber tires, up to 26,000 lb.	15
Solid rubber tires, up to 28,000 lb.	15

Front Axle Gross.—This is the maximum weight which manufacturer will allow to be concentrated on the front wheels of the truck. It will depend largely on the tire equipment and factors of safety contained in the axles, wheels, springs and frame.

Rear Axle Gross (weight) — This is the maximum weight which the manufacturer will allow to be concentrated on the rear wheels of the truck fully loaded. It will depend largely on fire equipment and factors of safety in the axle, wheels, springs and frame.

Gross Weight—This is the total overall weight of chassis, body, load and equipment. This gross weight may or may not be the sum of the front and the rear axle gross weights, dependent upon the allowances which the manufacturer wishes to make for the variation in load distribution, but in either case this is the most important weight on the plate, and it is the basis on which motor trucks will be rated in the near future.

Body, Load and Equipment.—This is the difference between the gross weight and the chassis weight and should be stamped by the manufacturer at the time the chassis leaves the factory. In the case of electric trucks, storage battery will be included in this weight. The weight of the load is purposely lumped with the weight of the body and the weight of the equipment and it will be necessary for the owner of the truck to actually weigh the truck after body and equipment have been mounted, and to subtract this tare weight from the gross weight in order to determine the freight load or carrying capacity of his vehicle. Most of the states require that the weight of the truck light, its capacity and its gross weight should be painted on the sides of the body. In other words, the truck owner will not be able to determine the actual capacity of his truck until he has determined the actual weight of the body, and the equipment mounted on the chassis.

Chassis Weight.—This is the weight of the chassis as built by each manufacturer and may vary with wheelbase, frame length, tire equipment, etc. Manufacturer should weigh each individual chassis equipped according to note on the plate, defining chassis weight. This actual chassis weight should be stamped on the plate and plate attached to the chassis before chassis leaves the factory. Chassis weight includes running gear, motor, battery cradle, driving and control mechanism, wiring, housing, tools, lamps, horn, license brackets, charging plug and cable; but without driver, battery, body, auxiliary power devices or equipment. Weight of bodies, whether built by the vehicle manufacturer or by a body builder to the order of the purchaser, should be kept within these allowances.

Standard Body Weight

Load	Body Weight Allowance Pounds
1, 1½ ton	1,200
2, 2½ ton	1,500
3, 3½, 4 ton	2,000
5 ton and over	2,500

Brake Capacity.—This should be determined by the manufacturer in the case of each individual chassis before it leaves the factory. A reasonable allowance should be made for variation in brake adjustment. This infor-

MAXIMUM SPEED **16** MILES PER HOUR. DO NOT EXCEED.
THIS VEHICLE, WHEN TESTED AT THE FACTORY, SHOWED A BRAKE CAPACITY WHICH ENABLED THE DRIVER TO STOP IT, WHEN LOADED TO ITS STATED CAPACITY AND WHEN RUNNING AT ITS MAXIMUM STATED SPEED IN **40** FEET ON A DRY, HARD LEVEL ROAD.

NOTE: CHASSIS WEIGHT INCLUDES COMPLETE CHASSIS, FRONT FENDERS, STEP, DRIVER'S SEAT, TOOLS, LAMPS, HORN, LICENSE BRACKETS, NORMAL QUANTITY OF FUEL, LUBRICANT AND COOLING MEDIUM; BUT WITHOUT DRIVER, BODY, AUXILIARY POWER DEVICES OR EQUIPMENT.

NAME AND ADDRESS OF MANUFACTURER

MADE IN U.S.A.

CHASSIS NUMBER

CAUTION OVERLOADING OR OVER SPEEDING WILL VOID YOUR WARRANTY.

MAXIMUM WEIGHTS	LBS.
CHASSIS (SEE NOTE)	6,300
BODY, LOAD & EQUIP.	8,000
GROSS WEIGHT	14,300
FRONT AXLE (GROSS)	6,000
REAR AXLE (GROSS)	12,000

Standard Caution Plate for Motor Trucks

mation is furnished to asist law enforcement officers in checking up operation and adjustment of brakes. All figures used in the above plates are for purposes of illustration only. These plates should be approximately 10½ in. long and 3¼ in. wide and should be riveted permanently

Standard Frame Widths and Lengths for Commercial Vehicles

Frame width, either 36 or 42 inches, for all sizes of commercial vehicles, measured back of seat. Frame length, back of seat, to be in full multiples of feet and half feet from 4 to 18 feet, thus:

Feet		Inches	Feet		Inches
4	(Equivalent to) ..	48	11½	(Equivalent to) ..	138
5	(Equivalent to) ..	60	12	(Equivalent to) ..	144
6	(Equivalent to) ..	72	12½	(Equivalent to) ..	150
7	(Equivalent to) ..	84	13	(Equivalent to) ..	156
8	(Equivalent to) ..	96	13½	(Equivalent to) ..	162
8½	(Equivalent to) ..	102	14	(Equivalent to) ..	168
9	(Equivalent to) ..	108	15	(Equivalent to) ..	180
9½	(Equivalent to) ..	114	16	(Equivalent to) ..	192
10	(Equivalent to) ..	120	17	(Equivalent to) ..	204
10½	(Equivalent to) ..	126	18	(Equivalent to) ..	216
11	(Equivalent to) ..	132			

NOTE—The standard frame lengths as adopted are independent of chassis load capacity.

to the chassis at some point where they can be readily seen, but from which it will never be necessary to remove them.

Plate once attached to chassis should never be removed unless chassis weight is increased or decreased by changes in tires, wheels, springs, axles or frame.

Cut Pronounced in Light Models

Analyzation by models and taking the 1,000 lb. capacity first, it will be noted that the low price was $689 in 1916, and high in 1921, says Automobile Trade Journal. The average for 1922 is the same, $970. The factors of supply and demand appear to have functioned in the case of the 1,500 lb., which average price was $1,179 in 1917, but increased steadily up to and including 1921, when it was $1,560. At the close of 1922, however, the makers cut off an average of $281. The 1-ton dropped its price $93 in 1917, but thereafter the price advanced steadily until 1921, when it was cut $182. In 1922 it was further reduced and with the exception of the 5½ to 7½-ton class, the reduction was the greatest.

The fluctuation of the 1¼-ton capacity group show a reduction on the odd years and an increase during the even years. The low peak was in 1917, $1,472. In 1921 the price was reduced $58. 1922 saw the average price reduced $299. The curve of the 1½-ton shows a steady increase in average price from 1916, when it was $1,881, to 1921, when it was $2,389. The reduction in 1922 was $107.

The average price of the 2-ton increased from $2,272 in 1916, to $2,908 in 1919, fell off $86 the following year, but advanced $29 in 1921. Last year the greatest increase was $418 in 1919. The biggest cut was $330 in 1922.

The 3½-ton, which increased steadily from 3,009 in 1916, to $4,144 in 1920, is another case of a marked cut. In 1921 the price was reduced $12, but last year it was cut $366.

The curve of the 5-ton shows a steady increase from 1916 to 1921, when cut of $284 was made. Last year a further reduction of $155 was noticed. As in 1921 the makers of the 5½ to 7½-ton made a large reduction. The average list of these models was reduced $676 in 1922.

The four models which showed an average advance of $111 in 1921 over the preceding year's prices are the 1,500 lb., 1½, 2 and 2½-tons. During 1922 they have decreased in price at an average of $254. The decrease in these four capacities may be ascribed to the factor of demand and decreased costs of units brought about by a greater production on the part of the unit makers.

3,000,000 Cars and Trucks Predicted for 1923

Based on figures for January and February, and depending somewhat on supplies of closed bodies, production of motor cars and trucks should approach the three million mark in 1923, according to a statement of Alfred Reeves, general manager, National Automobile Chamber of Commerce, in his address on the "Outlook for the Automobile Industry" before the 20th anniversary gathering of the automobile school of the West Side Y. M. C. A. recently.

January, Mr. Reeves said, is generally the poorest month of the year, yet we produced 240,903 vehicles, or 2½ times that of the previous January. February production is runing at about the same pace and if the industry is able to get sufficient closed bodies, which in turn depends to a large degree on being able to get plate glass production should increase, with excellent possibilities of 3,000,000 motor vehicles being made in 1923 as against a total of 2,577,000 last year.

Only Seven British Auto Builders Profited in 1922

Only seven British auto manufacturers made profits during 1922. The entire production of passenger cars did not exceed thirty to forty thousand during the year, while truck production remained slack throughout. Price reductions ranging from 10 percent on high grade models to 35 percent on smaller cars stimulated the demand somewhat. The London show saw a great increase in the number of low-priced two and four-seated passenger cars, selling between £175 and £300. The values of these cars, however, are not comparable with American makes in the same price class. Imports increased steadily throughout the year, while exports decreased as compared with 1921. Lower prices for American cars on the English market would considerably increase volume of sales. Larger business is expected for both manufacturer and importer in 1923.

Automobiles in Australia and Argentina

Australia and Argentina are much of a size, in about the same latitude south of the equator, with similar climates and predominantly flat topographically, and both are engaged in similar pursuits, mainly the raising of sheep and cattle and the production of wool, hides, and skins. The similarity extends to automobiles. Australia has 78,517 passenger cars and Argentina 77,367. Australia however, is well ahead of Argentina in trucks and motorcycles, the figures being, motor trucks: Australia, 3,900; Argentina, 776; motorcycles: Australia, 37,751, Argentina, 2,500.

Andre Citroen, one of the largest European manufacturers of passenger cars whose methods are generally considered a close approach to mass production is said to be considering the advisability of using standard American parts in the production of his car.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Wisconsin Truck Co., Madison, Wis., recently incorporated with $25,000 capital to manufacture motor trucks, has effected a merger with the Six-Wheel Motor Truck Co., Fox Lake, Wis., and is increasing its capital stock to $150,000. The factory opened at 18 N. Charter street in Madison Jan. 15 will be doubled in size and new equipment is now being purchased. A single order for 500 six-wheeled trucks with four-wheel drive has been booked for delivery to an oil company at Tulsa, Okla., beginning Feb 15. An output of 800 to 900 chassis in 1923 is assured by present contracts.

Standard Motor Car Co., has been organized under Delware laws to take over and operate the company of the same name, with plant at Butler, Pa., for the manufacture of automobiles and parts. The Standard Steel Car Co., Frick Building, Pittsburgh, formerly the parent organization, has disposed of its entire automotive interests to the new corporation. Executive headquarters will be at the Butler works. Plans are under way for factory facilities for the manufacture of a four-cylinder car, in addition to the present eight-cylinder. D. C. McCord is president.

General Motors Corp. has formed another company at Oshawa, Ont., to be known as the Cadillac Motor Co. of Canada, Ltd. A charter has already been taken out and the nucleus of the organization has been formed. The officers will include R. S. and P. W. McLaughlin as chief executives and H. H. Beaton as sales manager. It is understood that parts for the Canadian-built Cadillac are already in the Oshawa factories of the General Motors. Manufacture of the cars will be begun at once with steady production schedules already made out.

The Bessemer-American Motors Corp., W. Front street Plainfield, N. J., comprising a merger of the American Motors Corp. and the Bessemer Motor Truck Co., with plants at Plainfield and Grove City, Pa., respectively, is arranging for a consolidation of the two properties at one plant. Extensions will be made to accommodate the joint development, for which a fund of $200,000 has been provided. I. M. Lewis, formerly vice-president of the Hydraulic Steel Co., will be vice president and general manager in charge of production.

T. H. Field, Rice Lake, Wis., who recently was granted patents on a number of basic designs for units for motor vehicles, intends to build a factory in Rice Lake to put the car into production. Initial models were built under contract with Minneapolis machine shops. The new corporation is being organized with $1,000,000 capital under Delaware laws. The first construction will consist of a machine shop and assembling floor, with a foundry and other buildings to be added later.

Daniel L. Jones, Muskogee, Okla., and associates, stockholders of the O. K. Truck Co., have taken over the local plant at a forced sale of $62,000. It has been closed for some time past on account of financial difficulties. A new company will be organized, Improvements will be made and equipment provided for a daily output of four complete motor trucks, with service and repair departments for cars now in use.

Ford Motor Co. officials have organized the Fordson Coal Co., under Delaware laws, with capital of $15,000,000, to operate coal mines in Kentucky and West Virginia, recently acquired from the Pond Creek Coal Co., the Banner Ford Coal Co., and the Dexcar Coal Co. Plans are under way for additions in different plants, to include the installation of electric power and other machinery.

United States Motor Bus Transit Co., 911 Title Guarantee building, St. Louis, manufacturer of motor buses, will commence the erection of two two-story buildings, 200 x 200 ft., and 150 x 200 ft., on the Grand boulevard. The first will be equipped as a machine shop, assembling department, etc., and the second will be used for general operating service. It will cost $225,000.

American Bosch Magneto Corp., Springfield, Mass., has acquired the plant of the Reading Standard Motorcycle Co., State street, Reading, Pa., from the received for $30,000, and is said to be plannnig the establishment of a branch plant at this location. The equipment at the factory was secured by the Cleveland Motorcycle Mfg. Co., Platt avenue, Cleveland, for like sum.

Detroit Air Cooled Car Co., Wayne, Mich., is now situated on the Michigan Central railroad in the former Swift plant. It has also purchased 10 acres of land at the junction of the Michigan Central and Pere Marquette railroads. Offices have been added to the plant, which has been remodeled, and a heating plant has been installed. W. J. Doughty is president.

Inland Mfg. Co., General Motors building, Detroit, a subsidiary of the General Motors Corp., is arranging for the establishment of a plant at Dayton, O., to manufacture steering wheels and other automobile equipment. The new works will supplement the present Dayton-Wright plant, which is being utilized for a similar purpose.

Reo Motor Car Co., Lansing, Mich., will begin, in the early spring, the erection of a new storage and shipping building to cost approximately $500,000 and to have 640,000 sq. ft. of floor space. It will be three stories, 577 x365 ft., and will provide storage space for 3,000 vehicles. The train shed will accommodate 72 freight cars.

Ford Motor Co. plans to enlarge its Cleveland assembling works and to add additional equipment, involving an expenditure of $250,000. Under the new management it is stated that the entire Ford car and tractor will be assembled in the plant, which will add enameling, upholstering and body shops.

Ford Motor Co., will take bids at once for a one-story addition at its River Rouge plant for motor car and tractor castings. It has filed plans for its assembling plant at Torrence avenue, Chicago, with main building one story 502 x 1363 ft., estimated to cost $1,200,000, with machinery machinery.

Locomobile Co. of Am. plant at Bridgeport, Conn., will close for a month for changes in arrangement of old and new equipment. Approximately $300,000 is being expended in construction and new machinery. About 1,200 will be temporarily affected by the shutdown.

Ford Motor Co. has awarded contract to the American Bridge Co., Detroit, for a new plant at River Rouge Mich., for cement manufacture. It is estimated to cost more than $500,000, including machinery.

Ford Motor Co. of Canada, Ford, Ont., will change machinery of its entire plant to individual or direct drive which will necessitate the installation of 2,600 motors and will cost approximately $500,000.

General Motors Corp. has announced an expansion program for the Chevrolet plant at Bay City, Mich., with an approximate expenditure of $250,000 on alterations and equipment.

Studebaker Corp., South Bend, Ind., has started the construction of a new foundry, 650 x 720 ft., with a capacity for castings for 750 automobiles a day. Heretofore the company has purchased part of its castings from outside sources.

Harvey Spring & Forging Co., Racine, Wis., automotive

springs and forgings, contemplates the erection of an addition to its works at 17th and Murray avenues. Definite details will be announced later. E. J. Harvey is president.

J. W. Murray Mfg. Co., 1975 Clay street, Detroit, manufacturer of automobile fenders and other sheet metal products, has work under way on a new one-story building, 72 x 125 ft., to cost approximately $25,000.

Elkhart Motor Car Co., Auburn, Ind., has tentative plans for the erection of a new one and two-story works on the east side for parts production and assembling. Wilson Dennison is treasurer.

Reo Motor Car Co., Lansing, Mich., has plans for a three-story addition to its works, 365 x 577 ft., estimated to cost $500,000. R. E. Olds is president.

Bridgeport (Conn.) Motor Truck Co. has acquired the former plant of the Liberty Mfg. Co., Stratford, Conn., for the production of trucks and parts.

Spicer Mfg. Co., Pottstown, Pa., manufacturer of universal joints, will build an addition to its plant.

Body Builders

Millspaugh & Irish Corp., Indianapolis, has been organized with a capital of $1,500,000 to take over the company operated as Millspaugh & Irish, manufacturer of automobile bodies, with plant on La Salle street. The new company contemplates extensions and proposes to issue preferred stock for $425,000 and common stock for $106,250, a portion of the proceeds to be used for such purpose. Harry B. Millspaugh is president, and Clarence R. Irish, vice president and general manager.

Springfield (Mass.) Body Corp., operating at the former plant of the Smith-Springfield Body Co., has acquired the plant at Pontiac, Mich., previously used by the Friend Motor Car Co., bankrupt, for its Michigan plant. It aggregates 285,000 sq. ft. on a 16-acre tract, and will be remodeled and improved. With its recently acquired works at Bloomfield, N. J., the Springfield company proposes to develop an annual capacity of 15,000 bodies at the three plants.

Fisher Body Corp., Detroit, will begin the construction of a new plant at Pontiac, Mich., in the near future. It will provide closed bodies for the Oakland Motor Car Co and will have 300,000 ft. of floor space in the first three units and employ 2,500 men. Twenty-six acres have been purchased from the General Motors Corp., at Baldwin avenue and the Kennett road.

Woodward Body Works, Inc., Austin, Tex., recently reorganized, will operate a plant to manufacture truck bodies for Ford cars, comprising a main one-story building 105 x 300 ft., and four one-story structures, each 60 x 200 ft. Equipment will be provided for metal and wood bodies. Samuel Sparks is president, and J. A. Nichols, manager.

Mullins Body & Tank Co., Milwaukee, has been chartered to manufacture steel tanks and other special equipment for motor trucks. The authorized capital is $100,000. The principal in the enterprise is Clarence J. Mullins, long associated with the Heil Co., Milwaukee. Definite plans will be announced later.

Newman Commercial Body Corp., New York, has been chartered under state laws with capital of $25,000, to operate a plant for the manufacture of automobile bodies at 1745 First avenue, succeeding the former company of this name. S. and A. Newman head the company.

Studebaker Corp., South Bend, Ind., has awarded contract to H. G. Christman & Co., South Bend, for an addition on LaFayette street, to manufacture automobile bodies for closed cars. It will cost approximately $1,000,000 with machinery.

Lang Body Co., Cleveland, reports net profits of $107,748 for 1922. Business is declared good with large volume Dodge Brothers coupes and new orders for closed bodies for Lincoln cars received.

Towson Body Corp. of Detroit reports net sales for 1922 with December estimated of $8,037,564. Net profits before taxes, but after interest and depreciation charges, were $757,197.

Portsmouth Automobile Body Co., Portsmouth, N. H. has plans for a two-story addition, 40 x 100 ft. T. J. Boyan is general manager.

Watkins Commercial Body Co., 666-72 Genesee street Buffalo, is planning for the erection of a two-story addition, 30 x 150 ft.

Rhoda Body & Mfg. Co., Lima, O., has placed contract for the erection of an addition.

Quality of Gasoline Shows Improvement

Day by day, little by little, the quality of gasoline marketed in the United States seems to be getting better, states the Bureau of Mines as the result of a survey just completed. This, the seventh semi-annual survey of its kind made by the bureau, covered the cities of New York, Washington, Pittsburgh, Chicago, New Orleans, St. Louis, Denver, Salt Lake City, San Francisco, and Bartlesville, Okla. It disclosed the fact that the increase in volatility of gasoline, noted six months ago, is still present. This means briefly that the average gasoline is easier to vaporize, and consequently that it should be easier to start the lowly flivver or the stately limousine on a frosty morning.

Another important fact developed is the tendency toward greater uniformity in the character of gasoline marketed in the United States. In other words, gasolines bought in New York, Chicago, or Denver are apt to be more nearly similar than has been the case in the past. The bureau finds also that the seasonal variation from summer to winter gasoline is slowly decreasing.

The bureau found on the other hand that, of 129 samples of gasoline collected from these ten cities, 56 samples failed to meet federal specifications. New York city is the only city in which all gasoline samples passed federal specifications at all points.

In the present survey, taking the cities individually, there are some distinct changes noted. In comparison with January, 1922, the average for Washington shows an increase of 20 deg. in the initial boiling point and a decrease of 12 deg. in the 90 percent point. The averages for Pittsburgh, Chicago, and St. Louis, each show consistent drops throughout the distillation range with the exception of the initial boiling point, which was increased slightly. On the other hand, the averages for Salt Lake City and San Francisco indicate on the whole, a decrease in volatility. The average 90 percent point and end point of the San Francisco samples each rose 11 deg., while the same points of the Salt Lake City samples rose 8 deg. and 2 deg., respectively. In the distillation of the samples from Pittsburgh and St. Louis, it was found impossible to recover even 90 percent of some samples, when using a mixture of ice and water in the condenser bath according to the standard method of distillation. This would indicate that these samples contain an excess of low-boiling fractions, which is probably due to an admixture of an excess of natural gas-gasoline.

Detailed information regarding the seventh semi-annual motor gasoline survey is given in Serial 2444, by N. F. Le Jeune and L. G. Marsh, assistant chemists, which may be obtained from the Bureau of Mines, Washington, D. C.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

4899—Motor cycles of medium price, equipped with 4 to 5 horsepower engines—Austria. Agency desired. Quotations, f.o.b. New York. Correspondence, German.

4907—Passenger automobiles of first-class manufacture, trucks, and motor cycles—Austria. Agency desired. Quotations, f.o.b. New York.

4915—Automobiles, and accessories, and hardware articles—Sweden. Purchase desired. Quotations, c.i.f. Swedish port. Terms: Payment against documents.

4937—Bicycles, motor cycles, sundries, and boat motors—Finland. Purchase. Quotations, c.i.f. Helsingfors, Hango, or Abo. Terms: Cash against documents.

4956—Standardized automobile parts, such as motors, wheels, radiators, gears, brakes, steering gears, frames, and transmissions—Norway. Purchase.

4969—Machine tools for automobile repair shop, reforming press for iron, and foundry installations for bronze and malleable iron—Greece. Purchase. Quotations, c.i.f. Greek port. Terms: Payment arranged by confirmed letter of credit against documents. Correspondence, French.

4993—Automobiles, agricultural machinery, typewriters, steel rails, calicoes, and novelties—Serbia. Agency. Payment: Cash.

5025—Automobile tires, both clincher and straight side, and for the most part cord—Chile. Purchase or agency. Quotations, c.i.f. Chilean port.

5032—Leather cloth for upholstering purposes and other articles used in the upholstering trade—Norway. Purchase. Quotations, c.i.f. Norwegian port. Payment to be made through bank in New York.

5043—Automobiles, motor cycles, bicycles, and accessories—Sweden. Purchase and agency. Quotations, f.o.b. New York.

5044—Small vulcanizing outfits and automobile accessories—Italy. Purchase or agency. Terms: Cash against documents. Correspondence, Italian.

5078—Tires of the best grade—Austria. Agency. Quotations, f.o.b. New York.

5085—Machinery for repairing and reinforcing automobile tires—Spain. Purchase. Quotations, f.o.b. New York. Correspondence, Spanish.

5087—Automobile accessories and tools—Denmark. Purchase. Quotations, c.i.f. Danish port. Terms: Cash against documents.

5100—Fire fighting automobile of 70 horsepower, with a pumping capacity of 1,800 liters per minute—Sweden. Purchase. Quotations, c.i.f. Swedish port.

5106—Motor accessories and motor novelties — South Africa. Agency.

5275—Bicycle and motorcycle chains, parts for motorcycles, motors, and other parts in the automobile and motor trade; and a low-priced automobile — Sweden. Purchase and agency. Terms, cash against documents.

5277—Automobile and motorcycle accessories and cutlery—Italy. Agency.

5279—Benzine motors, tractors, and small automobiles—Czechoslovakia. Purchase. Quotations, c.i.f. Hamburg or Adriatic ports. Correspondence, Czech, German, or Magyar.

5283—Automobile accessories — Switzerland. Exclusive agency. Quotations, f.o.b. New York. Terms, payment against documents.

5315—Leather for automobile upholstery—Italy. Agency.

5317—Nonskid automobile chains and spring bolts—Norway. Agency.

5322—Tire setting machine for affixing metal tires on wagon wheels without heating tire—Canada. Purchase. Quotations, f.o.b. port of shipments.

5344—Engineering tools and small machinery, hardware lines, fancy goods, motor and cycle accessories, mecanical goods, and automobile trucks — Australia. Agencies. Quotations, c.i.f. port of New South Wales. Terms, cash against documents.

5353—Automobile tires, tubes, accessories, etc.—Ireland. Purchase.

5363—Electric lamps for home and for motor cars, electric air pumps for automobiles, electric plants for home use, and wireless apparatus—Scotland. Purchase and agency. Quotations, c.i.f. Scottish port.

5378—Pneumatic automobile tires, in millimeter sizes only—England. Purchase. Quotations, f.o.b. New York.

5393—Motorcycles and accessories — Australia. Agency. Quotations, f.o.b. New York.

5400—Automobile tires of the best quality, metric and inch clinchers—Hungary. Agency. Quotations, c.i.f. Hamburg. Terms, cash against documents.

5407—Hardware, tools, automobile accessories, and garage and service-station equipment—South Africa. Agency. Quotations, f.o.b. New York.

5417—Automobiles, trucks, tractors, dairying and farm machinery and implements, machine tools, automobile accessories, small marine motors, and labor-saving devices and machinery—New South Wales, Australia. Agency. Quotations, f.o.b. New York or San Francisco. Terms, cash against documents or confirmed letter of credit.

5422—Electric automobile trucks — France. Purchase. Quotations, c.i.f. French port. Terms, cash. Correspondence and particulars as to cost of operation and technical descriptions desired in French.

5491—Automobiles, motorcycles and bicycles, and their accessories—Rumania. Agency and purchase. Quotations, c.i.f. Rumanian port.

5431—Light motorcycles and automobiles — Austria. Agency. Quotations, f.o.b. New York. Terms, payment against documents.

5460—Materials for the vulcanizing and repairing of worn pneumatic automobile tires and inner tubes—Syria. Purchase. Quotations, c.i.f. Syrian port. Terms, cash in United States currency. Correspondence, French.

5484—Automobile accessories of all kinds, excepting tires; and oils and greases—Belgium. Purchase and agency Quotations, c.i.f. Belgian port. Terms, cash against documents.

5487—Motorcycles and automotive accessories (novelties)—Austria. Agency. Quotations, f.o.b. New York.

The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1, Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3, Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

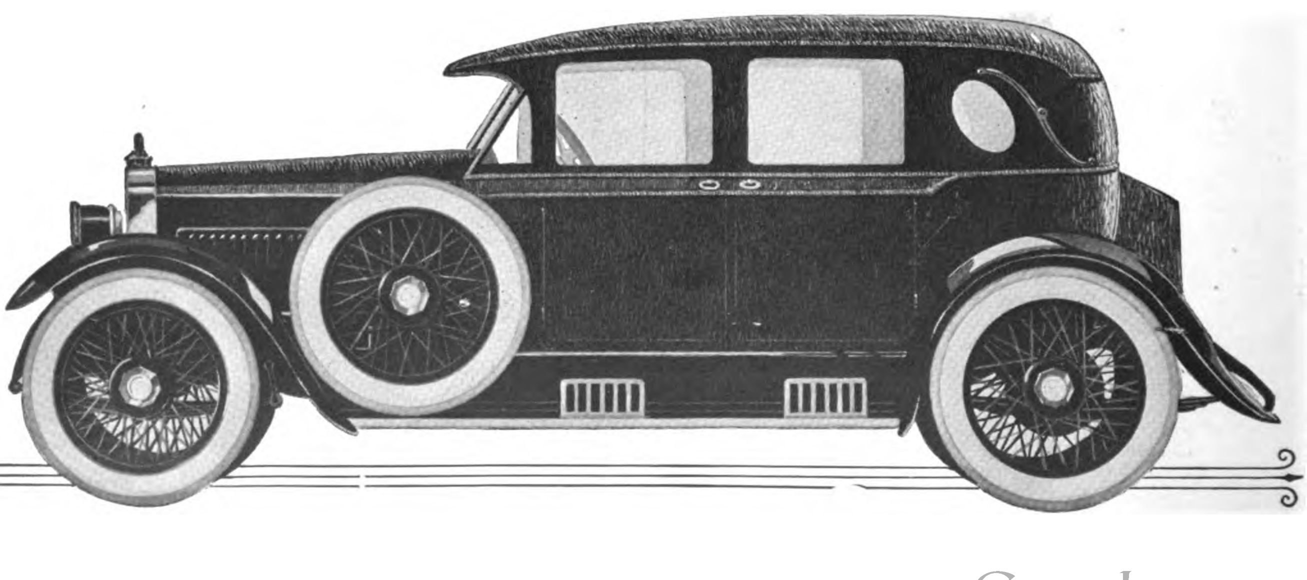
The Automotive Manufacturer

The Hub of Automotive Engineering

BODY BUILDING - AUTOMOTIVE PARTS - ALLIED INDUSTRIES

Vol. LXIV. No. 12 MARCH, 1923 $2.00 Per Year Issued Monthly

Published monthly by The Trade News Publishing Co., Heptagon Building, 153 Waverly Place, New York City.
Entered as second-class matter June 23, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879.



The Automotive Manufacturer

A Consolidation of The Hub and Automotive Engineering

Vol. LXIV. NEW YORK, MARCH, 1923 No. 12

Air Cooling Progressing Rapidly

BY MORRIS A. HALL

Recent New Models and New Forms of Older Makes Revive Public Interest in the Simplified Cooling Method—More New Models in Preparation

WHILE persistent opponents of air cooling for motor vehicle engines may consider it as undesirable and unsuitable, the interest in it is revived periodically, and right now is undergoing its greatest revival. In fact, so strong is the tendency in this direction that it might almost be classed as the outstanding trend of design for 1923.

Whatever individual opinion relative to the air-cooled motor may be, the fact remains that practically all motorcycles are made in this way, and no one can deny that, within their natural limitations and scope, motorcycles are serviceable and satisfactory. Certainly no complaint about cooling has yet arisen.

During the war, there was a strong faction which advocated that all airplane engines logically should be of the air-cooled type. This group argued that the proven success of the air-cooled forms had been such as to warrant displacing all water-cooled machines. While this would be extreme both as a statement of fact and as an economic policy, the fact remains that air-cooled airplane engines, in a great variety of sizes, number of cylinders, power output, disposition of cylinders and other parts and features, were successful and in the main, satisfactory. As will be mentioned later, much of the present air-cooling movement is based on these war successes of this method in aerial work.

There is no doubt that the public demand, of recent years, for fewer parts and greater simplicity generally, has aided the movement towards air cooling. Still more recently, the aftermath of the war was a wave of depression which brought out a cry of economy. This in a motor vehicle must begin with low weight and few parts. Hence, the economy wave undoubtedly had something to do with the present movement toward air cooling.

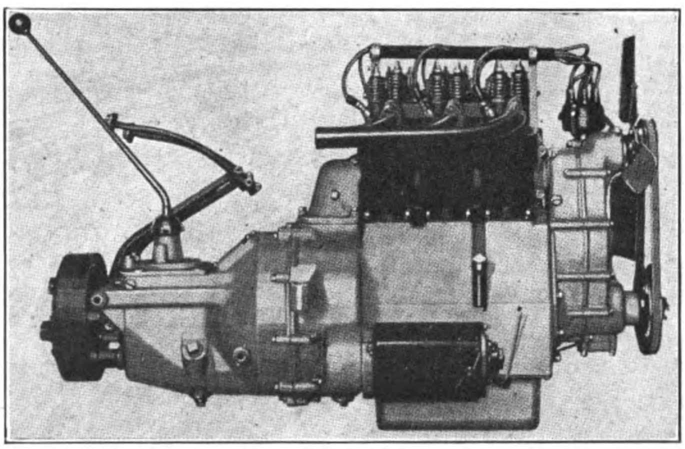


Fig. 1. The D. A. C. V-type six-cylinder air-cooled power plant.

That there is such a movement, no well-informed person will deny. The industry admits it and designers are very curious as to the progress of this, that and the other maker known to be working on an air-cooled model. The public feels that it is coming from the small amount of information which has been allowed to leak out, as well as from a simple consideration of the situation. Five years ago, there was one make only; four years ago there were two; three years ago there were three; two years ago five. Today there are six, with two others almost ready to go into production and certain to be added as active manufacturers during 1923. This would bring the total to 8. Several others are suspected of working on the problem so it is possible the final 1923 total may be higher.

These represent, taken collectively, practically the whole range of motor construction, barring only the freaks. Thus, three are straight sixes, one is a V-type six, and two are straight fours (or more correctly three, for one maker in this goup has two sizes and models). On the new models about to be put on the market, one is a straight six, and two are st.aight fours. Another possible addition, on which some work has been done, is a small four.

One maker's product ranks in the highest price class, two others are close to it, the other three (or four) are in the lower price classes. The models still to come are more or less to be grouped with the latter.

With all this work going on, and in a few cases, with capacity sales maintained over a number of years as proof of demand, this is apparently a tendency of more than passing moment. Large companies can not afford the huge expense of tooling up for a new model, unless they have satisfied themselves in advance that it is going to be a good seller, and thus, a profit-maker. In this connection, while the postponement of the Franklin four from 1922 as originally planned to 1923 or later was more than offset by the bringing out of the Chevrolet four by General Motors, and subsequent statements that the Oldsmobile six, a new air-cooled model, is about ready for the market, with the factory prepared for large production.

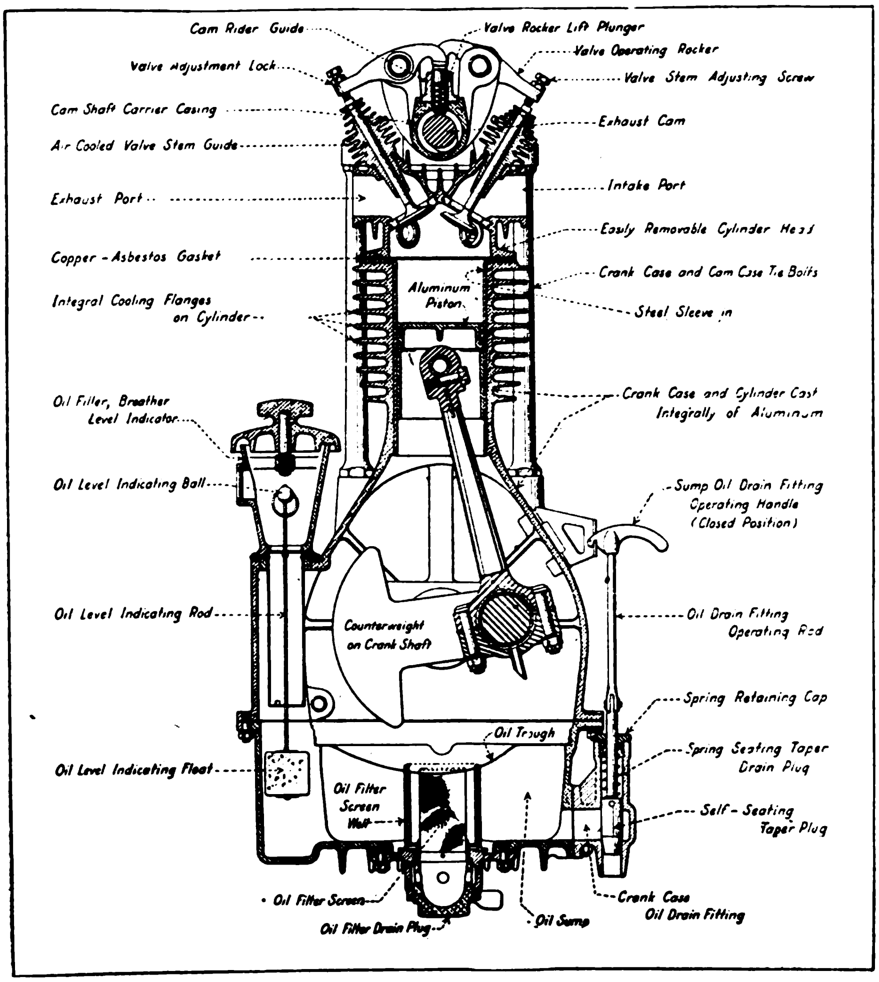


Fig. 2. Cross-section of the Page four-cylinder air-cooled engine.

Types of Air Cooling

It may be said that there are three general types or methods of air cooling. These are (1) by natural draft, (2) forced draft by suction, (3) forced draft by blower.

In group one lie all the motorcycle engines, the new D.A.C. six, shown in Fig. 1; the Page, shown in Fig. 2, and others. In this form, the efficiency of the cooling depends upon the size, shape and materials of the projecting fins, their disposition relative to the forward movement of the vehicle, and the normal vehicle speed. It is in this matter of fin disposition and arrangement that the aircraft engine men claim the greatest advances have been made recently, and that all this is due to the work done by air-cooled aircraft engines during the war. In addition, the recent use of a new raw material for fins, with superior cooling qualities would seem to broaden the situation. For the greatest all-around success it would seem that this form should have overhead valves. Two of the makes mentioned above are so constructed.

In general, this is the simple form with the fewest number of parts, but with the possible doubt in the public mind, perhaps brought forward by the very simplicity itself, as to sustained cooling ability. In addition, the oldest and foremost manufacturer in this field was for many years an advocate of this method but later abandoned it.

In group two, this is the first step beyond natural cooling, that is the addition of a suction fan near the natural outlet for the engine cooling air to assist the passage of such air and add to the volume which can be moved through in unit time. Holmes would seem not to stand alone in this class, and suggested improvement on a new Holmes model soon to be put out appear to hint at a change. Franklin graduated into this group from natural cooling or group one many years ago, but more recently, have given it up for a supposed better plan.

The next or last step is the use of a large, and very powerful blower to force all the air through, in tremendous quantities, instead of having natural or assisted passage of the cooling medium. This was brought out many years ago on the Frayer-Miller engine, which has not been built now for eight or more years. On that particular car, it was a successful method. It has been adopted recently by Franklin, is the method used on the Fox, and also on the new Chevrolet. Considering that the new Oldsmobile six started from the same source as the Chevrolet, it is not unreasonable to predict that it too, is of the blower-cooled type. All these have overhead valves. An advantage which is being produced now is that the complete metal enclosure of the tops of the cylinders by the air duct reduces the valve and other engine noises to such an extent as to make the engine of this design more quiet than a water-cooled model of equal size and power. This may be true in the case of Fox and Franklin on which a duct of machined and fitted aluminum is used, but it certainly could not be claimed for the Chevrolet on which the overhead duct is of light thin, sheet iron, calculated to aggravate noise rather than suppress it.

What would be a fourth form does not exist today, although engines of this type were built years ago. This is the form in which hollow pins are screwed into holes bored and tapped part way into the thick cylinder walls. The air passes through between these cooling pins, and also along the outside cylinder surface, between pins. It cooled well enough in the old Knox and other contemporary models, but its largest drawback was the expense of drilling and tapping the many cylinder holes, and threading the multitude of cooling pins. A somewhat modified

form is being tried ont in England, that is an aluminum cooling member for the upper part of the cylinder is screwed only a cast iron shell or working cylinder bore. The idea of this combination is three-fold, to reduce the cost of preparing the cooling unit, if it may be called that, to save weight, to simplify the castings used so that replacements cost less and foundry losses are smaller. If this proves up in the hands of the public, it may be the final form of the lower priced air cooled engines, including those for motorcycle, truck and tractor uses.

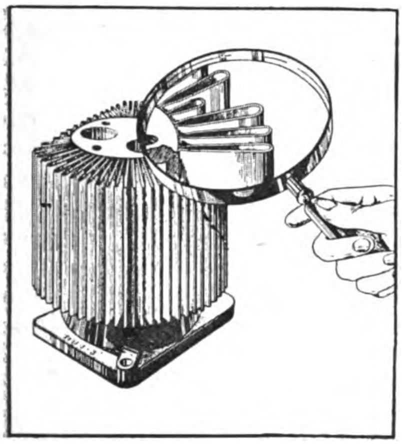


Fig. 3. The cylinders with copper fins as used on the new Chevrolet air cooler

It will be of interest to describe the various models in some detail. Thus, the Franklin has six cylinders of 3¼ bore and 4 in. stroke, has a 115 in. wheelbase, and is said to weigh slightly less than 2,000, in the five-passenger model. The engine has individually-cast cylinders with overhead valves operated by rocker arms. Each cylinder is surrounded by vertical cooling fins, cast integrally and surrounded by an aluminum air jacket so that all air is forced to travel past the air-cooling fins and cylinder surface. With the new blower cooling it is claimed that 2.5 times as much air is circulated through the jacekts, at a given speed, as with the previous suction system, and with a material reduction in the power consumption of the fan. The large open grill at the front of the hood permits the passage of four times as much air as is used for the blower; the excess being used to cool the outer edges of the cylinder fins, and the aluminum crankcase which receives its heat from the oil. The hot air from the blower is diluted and cooled by this stream in such a way that the average temperature of the air that passes under the car is but slightly above atmospheric.

As before, the cylinders are cast separately. Cylinder and head are a single casting. A clever turn of the fins does away with the necessity for a separate outer jacket, and reduces the center-to-center distance of the cylinders; so that the new engine is of simpler design and more compact than its predecessor.

By the use of duraluminum the connecting rods have been materially lightened, the figures being 1.25 pounds for the duraluminum rod with die-cast end, as against 2.2 pounds for the steel rod formerly used. The weight of the piston, with rings, pin, and pin-retaining ring, is only 1.394 pounds, giving an extremely low weight for the reciprocating members of the engine.

The Holmes is quite attractive of line, is lower than the Franklin, has half-elliptic springs, a more conventional bonnet, and in other ways comes closer to being the average motorist's idea of a conventional automobile. It is somewhat larger, having a 3½ x 4¼ in. six-cylinder engine, a 126 in. wheelbase, 34 x 4½ in. cord tires, and a seven-passenger body, where the Franklin has a five. Also the price is somewhat higher, for the touring car. It has suction cooling, like the Franklin, with this difference: the air when it leaves the centrifugal fan is directed to the rear by specially-shaped openings, and it is claimed that this slight modification greatly reduces the back pressure on the fan, and thus increases its capacity for handling air; in fact, it is stated that, because of this device, called an aeroduct, the fan actually has twice the capacity, and, in proof of the contention that the engine is more than amply cooled, a radiator shutter at the front reduces the air supply in cold weather.

The Holmes also has overhead valves, two exhaust and one intake per cylinder. Vertical cooling fins are used as in the Franklin. This car also uses a Sirocco fan as a flywheel. The fan handles 1,760 cubic feet of air per minute when the car is standing still, and it is said that when the car is running fast on the road the figure is doubled.

The Six-Cylinder Fox

The new Fox, made by the Fox Motor Car Co., Philadelphia, Pa., is attracting much attention because it is as fine a looking car as has ever been built in America. It is a low car with a fine sleek-shaped bonnet and a smartness of appearance that has never before been attained by air-cooled cars, and few water-cooled cars can surpass it in looks. It has a honeycomb screen at the front in lieu of a radiator, and the imitation is so good that the average motorist walks around the car without ever exclaiming "that's an air-cooled car." For an air-cooled car the engine is extremely neat, and the car impresses one with the idea that here is the best turn-out air-cooled automobile to date. Incidentally, it is larger than any previous air-cooled machines, having a 3¼ x 5 in. six-cylinder engine, a wheelbase of 132 in., and 32 x 4½ in. cord tires. It really is a large car, and, of course, the price is in keeping for the touring car.

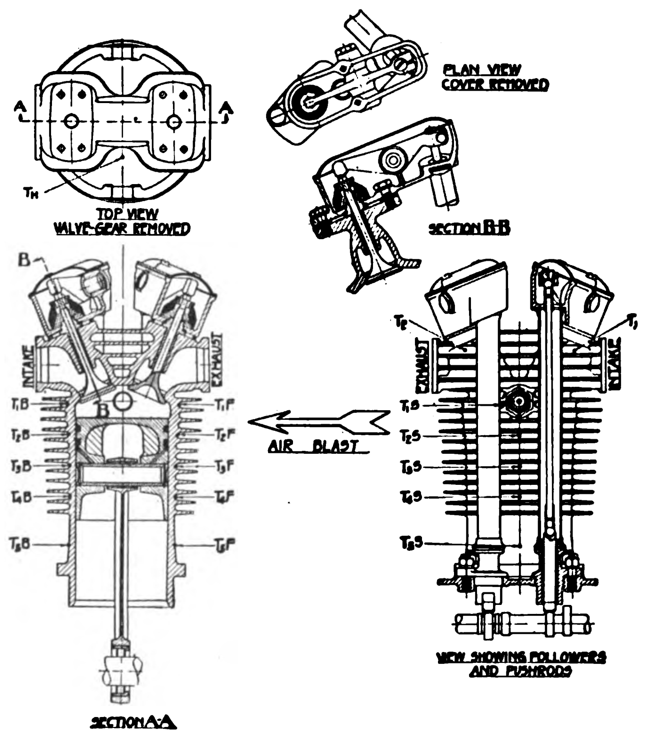


Fig. 5. B. S. A., a new British air-cooled car uses this cylinder unit

It is said to be an excellent performer, and was designed to give the economy and other advantages of the air-cooled principle and at the same time retain the power, speed, and flexibility of the larger water-cooled cars. The result is a large high-class vehicle, which, however, is ex-

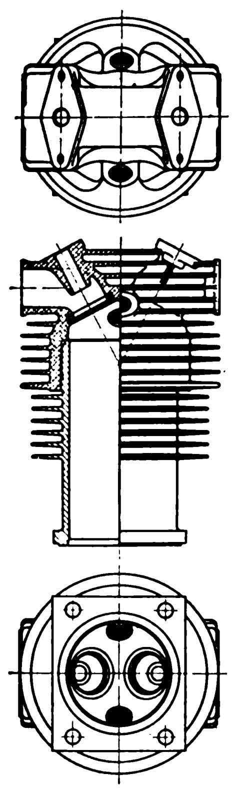
tremely light for its size, weighing 19 cwt. It has a road speed in excess of 60 miles per hour.

How the Cooling Draught is Induced

The most interesting unit of the car is naturally the new engine. Its cylinders are cast separately, the fins being integral and milled to uniform thinness. Unlike most previous air-cooled designs, the cylinder heads are separate so that it is not necessary to remove the cylinders in order to grind the valves. The Sirocco fan fly-wheel is placed in front of the engine instead of at the rear. This fan forces a large column of air through an aluminum duct or passage, which extends over the tops of the cylinders and covers the valve gear. Air is drawn through the radiator screen and forced through the duct and through the cylinder jackets surrounding the fins. The duct grows smaller to the rear to give better air distribution. This method of cooling does away with air noises, since the duct keeps the noise in. The valve mechanism is easily reached by taking off a cover which runs the whole length of the duct.

50 h.p. at 2,200 r.p.m.

Inasmuch as this is the finest air-cooled car built to date, a fuller description is merited. The individual cylinders have detachable heads fitting over a tapered shoulder on the cylinder so as to avoid the use of a gasket; this feature is unusual, at least in American practice. The valves, extending down through the head, are operated by rocker arms and vertical rods. The camshaft drive is behind the fan flywheel. The crankshaft is a seven-bearing type, drilled for forced feed oiling to main bearings and connecting rods. The pistons are of aluminum alloy, with long slotted skirts so as to reduce piston slap and permit of small clearances being used. The lubrication system comprises a gear pump forcing oil to each of the seven bearings, and at the rear of the crankshaft there is a take-off which supplies the camshaft. The engine develops 50 h.p. at 2,200 revolutions per minute, and the torque curve is fairly flat.



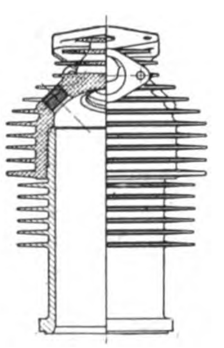


Fig. 4. Motorcycle cylinder with aluminum head or cooling unit screwed onto cast iron barrel.

The new D.A.C. is unique in a number of ways. It is a six-cylinder model, the cylinders being arranged in a V, with three cylinders in each side. It is supposed to sell at $1,500 or slightly more, weighs 1,740 lb., has 115 in. wheelbase, and 31 x 4 in. cord tires. The cylinders are set at an angle of 30 deg. No special provision is made for cooling, yet it is said to run for hours indoors without heating up. The cylinders have annular cooling fins similar to a motorcycle. Their size is small, approximating motorcycle size, that is 2⅞ bore by 4 in. stroke, motorcycle cooling methods are deemed sufficient, and do work out in practice.

Valves Are Pulled Open

Another interesting departure lies in the valve mechanism. While overhead valves are employed, the usual rocker arm construction is discarded in favor of valve rods which are actuated by a direct pull exerted by a camshaft placed in the center of the V. Because of the V construction the engine is unusually short. Its weight is 193 lb., and its horsepower development is stated to be 32. The crank case is only 14 in. long, and the crankshaft has a diameter of 2⅛ in. A multiple-disc clutch and a three-speed transmission are in unit with the engine. The ignition unit is mounted at the front of the V and the carbureter at the rear. The camshaft is driven by silent chain, and, in accordance with European practice, the service brake is on the transmission.

Another new air-cooled car of which little is known beyond rumor is the Sun. While details are not available at the moment, it may be said that it is the smallest car ever turned out that has an appeal to the eye. The Sun is a good looking roadster model for two people, and it sells for less than $500. It has a four-cylinder air-cooled engine of extremely small size. The cylinders have annular cooling fins, and a fan is used to aid air circulation. Additional cooling effect is obtained by a large air scoop in each side of the bonnet which catches the air that passes between the fender and the side of the bonnet and shoots it into the cylinders. A kick starter forms the unusual feature.

The Page Aero-Type Engine

The Page motor is a four-cylinder unit of comparatively small size, two models being built, one for a smaller or Ford-size chassis, the other for a larger model, to be equipped with five-passenger bodies. The motor has an overhead valve equipment, with overhead camshaft, this being removable as a unit. It is to this arrangement that the likeness to airplane engine construction is largely ascribed. Certainly it makes for ready accessibility, and as with all overhead valves and spherical combustion chambers, large power output. The engine is rated at 30 h.p. at 2,800 r.p.m. The cylinders are of silico-aluminum alloy, and the heads are air-cooled. Cylinders are cast integral with the top half of the crankcase, liberally flanged for cooling, and, to resist piston wear, are provided with steel liners which are accurately ground after insertion, thus insuring a perfect and smooth bore.

The cooling system, because of the design, is one of the most important factors and one which, in great measure, accounts for the practicability and utility of the power plant.

Several features have been patented by Major Page, chief of which is the geared fan drive. This drive has a with an automatic releasing clutch, with in conjunction cast aluminum, four blade, true pitch, propeller type fan with the well ribbed aluminum cylinders should give freedom from overheating.

The cylinders and heads, being aluminum, have greater conductivity than cast iron. There are no pipes or connections to break or leak.

The pistons are of a new type, made of constant clearance aluminum alloy, with a split skirt to insure a correct fit. They are carefully sized to prevent piston slap, and are inspected and weighed to insure even balance. They have a flat top which is highly polished, thus minimizing carbon deposits which are so apt to occur where

(Continued on Page 29)

Increasing Use of Dull Finish for Motor Cars

Reasons Why This Finish is Being Used More and More—Methods of Producing it—Color Schemes Suited for it

FOLLOWING the wide interest in, and great discussion of the dull finish for motor cars, each succeeding show uncovers more and more bodies finished in this way, says a writer in the Decorators' and Painters' Magazine (London), although it is not a finish of which painters will approve. The truth about this class of finish is that it cannot be popularized—the chief reason being that it will not permit of cleaning with any of the renovators now known to the trade. It rapidly deteriorates in appearance, and is particuarly susceptible to dirt and roughage attacks. A widely known firm in New York makes, we believe, a patented paint for the dull finish, which is superior in appearance to most others.

But as much of this dull finish work is attained through the use of a dull color made with raw linseed oil and turpentine, it is hardly necessary to state that such work is inferior not only in looks but in wearing properties. Some of the specimens seen at the last New York show carried a smutty, greasy, half-alive gloss upon which dust and dirt collected with unusual celerity.

Such work cannot be striped or ornamented successfully, because the lining and ornamental features require the protection of varnish generously flowed on—an impossibility when the varnish is penciled on.

For the dull finish, the same coats are required as in the case of the finish of full lustre, except that harder drying rubbing varnish, color varnish and finishing varnish are used. The final coat of hard drying body varnish is rubbed first with water and pumicestone flour, then brought to the desired effect by rubbing lightly with rottenstone and crude oil. By this method the elasticity of the various coats in which varnish plays the chief part is insured.

This type of finish has the advantage of being easily cleanable; indeed, it is nourished, and made brighter and finer, by an occasional renovation with a good reliable cleaner. Being a full varnish finish, it is also dependable and durable.

The Possibilities of a Good Remover

The question is sometimes asked: "Is it possible to remove the baked-on finish with varnish remover?" It is not only possible, but it is being performed every day. There are plenty of varnish removers, both liquid and paste, that will do this work effectively.

The writer recalls a case where one man, using equal parts of paste and liquid remover, removed the baked-on finish from a five-passenger car in a little over four hours.

For cleaning steel surfaces we always advise the sandblast, but not all shops are equipped with compressed air and the other apparatus required, so that paint and varnish removers must often be relied on.

As soon as the old finish has been removed, clean off the surface with gasoline or turpentine, preferably the latter. A second and a third washing is the best plan, for if any traces of the remover are left on they are sure to affect injuriously the succeeding applications.

The surface should then be promptly primed, in order to prevent corrosion setting in, due to the moisture always present. Some operators clean off the prime one side of the car immediately after the removal of the old finish, before proceeding with the other side.

In the work of removal it does not pay to use alkalies or caustic soda, washes or lye dips. These are "mussy" and obsolete methods which make the work of cleaning the surface laborious and expensive.

Individual Color Schemes

A new city custom is for milady to select her own car colors, and often these are quite original and sometimes sensational. Her selection may be based on a study of the color scheme of her favorite gown, for instance. Conspicuous examples of such coice to be seen along upper Broadway include several shades of dull red, akin to the shade of the old-time firecracker, which are used for panel effects in town cars as a contrast with the brighter reds.

These red panels may advantageously have the moldings dividing them painted black. This will intensify the red, and give it a setting calculated to emphasize its individuality. Lines of white, gold and contrasting shades of red may be employed as ornamental features.

These special colors need not be confined entirely to the red pigments. Blues and greens of distinction may also be employed.

This custom of New York women is likely to spread to the small town, and warrants the attention of automobile painters. Such special work can be taken care of by the country painter, and will yield a better profit than his regulation work. When well done, it confers a prestige on the shop that means an attractive business at advanced prices.

Possibly the main drawback to the use of greens and blues from the standpoint of the small town painter is that they require a superior preparation of the surface. The reds of dull and smarter shade serve to obliterate surface defects or render them less conspicuous. With a few lining effects these defects are rendered still less noticeable.

With the green and blues, however, only a degree of refinement out of proportion to what is required in developing other colors makes the finish completely satisfactory. But when so made, the result in tone and quality will prove most satisfying. Enrich the color field with some good lining work, and these blues and greens can be supplied in a character to suit the fancy for individual shades and selections.

Black is perhaps the most difficult of all pigments to produce upon the surface without showing imperfections. After the surface is rendered smooth and level and free from defects, the black must be developed without any brushy or coarse conditions.

The best grades of black are less solid covering colors than some of the cheaper grades, and with the former it may be necessary to use two coats. It is never safe to gauge the quality of a black from what it will do in covering the surface. What it will do when the surface is really covered is the most important thing.

Blues and greens are enriched by contrast with black, for which reason the moldings are always painted black.

It is also because of this feature that black is generally employed on the upper body surface of enclosed cars.

The blues may be striped effectively with lines of arctic white, silver white, black and gold, and even with some of the dull reds—Tuscan red being one of these. Greens becomingly carry lines of gold, carmine, black and contrasting shades of greens, either lighter or darker.

Auto Export Outlook

The world total of passenger cars and motor trucks is 14,612,161, of which 2,254,785 are outside of the United States. Motorcycles in all countries total 893,627 of which only 210,000 are in the United States.

The United States and Canada exported during 1922 more than 116,000 cars and trucks; the United States' share of over 78,000 represents an increase of more than 100 percent over 1921.

The prospects for the entire line of automotive products in practically every foreign market are much better than one year ago—and yet during 1922 Australia alone absorbed over 24,000 American and Canadian cars and trucks, as well as slightly more than 3,700 American-made motorcycles.

To what extent can our automotive exporters expand their foreign business?

This question cannot be answered here, but in "Commerce Reports" of Feb. 19 and Feb. 26, facts are presented which will enable the automobile exporter to gauge the pace in which individual markets are absorbing cars and trucks and thus, to a modified extent, accessories and equipment. These articles include data of interest to every executive.

Automotive exports from the United States are shown from 1913 on and their destination during 1921 and 1922 —including charts showing the inter-relationship of our exports with those from Canada, and the fluctuation in the yearly production and monthly exports from 1913 to 1923.

A birds-eye view is given of practically every one of our foreign markets—a few lines reviewing the outstanding automotive developments in these countries during 1922 with a prospective of the future.

Coupled with this review and economic summary of every country are given the vital factors affecting business conditions and buying power during the past year which permits conclusions to be drawn as to developments in 1923.

Our Used-Cars Not Wanted in Australia

Australia is not a profitable market for the exportation of second hand cars of the lower priced variety. The Australians have a well protected automobile body building industry and most automobiles are imported without bodies to avoid the heavy import duty of £60 assessed on this part of automobiles.

In the importation of second hand cars, regardless of the fact that the body is old this impost of £60 is assessable. The trade commissioner states that in view of the heavy body impost, and the relatively cheap price of second hand cars in the Australian market such contemplated step as the exportation of second-hand cars of the lower priced variety would be inadvisable. Similar conditions prevail in nearly every foreign country. They all have used car problems of their own and we will have to keep our used cars at home.

1924 Motor Show to be Held at 8th Coast Artillery Armony

Because of the continued growth of the national automobile show held annually in New York City, the industry has been forced to abandon its custom of holding the event at the Grand Central Palace, and has been able to secure the Eighth Coast Artillery Armory, 196th street and Jerome avenue, for the 1924 exhibition which will be held Jan. 5-12, inclusive.

This armory is the largest exhibition building in the world not having interior pillars. It affords 150,000 sq. ft. of unobstructed ground floor space and 24,000 sq. ft. in the balcony. This means that every car exhibitor can have space on the main floor and that there will be ample room for the public to get a ready view of all the models on display.

The building is at one of the express stations of the Lexington avenue subway and is within 28 minutes of 42d street. There is ample parking space around the building so that it is readily accessible for motorists.

The new location is favorable for the trade as the armory has an assembly hall which will seat 800, thus enabling the factory organizations and other associations connected with the industry a place to hold meetings in connection with the show.

The restaurant at the building accommodates 700 and will be available for group luncheons and dinners.

Daimler Prize for Coachwork

A noteworthy incident of the year 1922 in Great Britain has been the generous offer of the Daimler Co., Coventry, to provide the sum of 100 guineas and a gold metal as a prize for the best piece of British coachwork exhibited at the Motor Show Olympia, the organization of this competition and its arrangement being left in the hands of the Council of the Institute of British Carriage & Automobile Manufacturers. The council accepted the offer with the greatest satisfaction, as a means whereby the needed stimulus to improve the grade of coachwork generally would be given, and immediately set about outlining a scheme by which the intentions of the donors might be carried into effect. Unfortunately difficulties were met all along the line and still exist, the Society of Motor Manufacturers and Traders refused to cooperate, bringing up the proposal to a full stop, and effectually preventing it from being carried out this year. The council, however, does not despair even now of being able to successfully carry out the project in connection with the 1923 show, and negotiations are on foot with that object in view; it is to be hoped that circumstances will not occur to defeat a project calculated to be productive of much benefit to the body building industry.

February Produced 270,995 Cars and Trucks

February motor vehicle production was the third largest month on record. The output of 270,995 cars and trucks is regarded by the industry as indicative of a big year as February is usually a light period. The production figure for the past month is 125 percent greater than the second month in 1921. The previous high mark for February was 180,000 in 1920.

The three record production months are: June, 1922, 289,011; August, 1922, 272,538; February, 1923, 270,995.

Novel Wheel Saves Wood--Woods for Wheels

Large Saving in Wood Used in Construction of New Wheel, Stronger and More Resilient—Woods Which May Be Used for Wheel Work

WHETER the claimed saving of 25 to 30 percent of wood required in making wood wheels materializes or not, the automotive industry will welcome a new wheel which appears to have many other advantages. In that two present parts are combined in one, it is more simple. In that the one part is lighter in weight but fully as strong as the former two, it saves weight. In that it replaces a raw material which is rapidly getting very scarce and equally very high in price with one which is available in unlimited quantities and at a reasonable price at all times, it is economically desirable.

The new design is intended primarily for truck wheels, but is being adapted for heavy car use, also. It has been adopted, after long tests, by one prominent truck manufacturer as standard equipment. In this new design, the wood spokes are retained but no wood felloe is used. In place of this is an inverted channel section of steel, which takes the place of the ordinary S. A. E. band as well as the wood felloe. The manufacturers claim that the spoke has a complete bearing of the end grain on metal. The weakest point of the wood wheel, the seating of the spoke shoulder in the felloe, is done away with. It was at this point that practically all failures of wood wheels originated. By retaining the wood spokes, the manufacturers assert, they maintain the shock absorbing possibilities of wood and the new construction adds strength due to the feature described. The new wheel weighs from 25 to 30 percent less than the regular wood wheel.

In this connection, it is important to note that the public insistence on white hickory for wood wheel parts causes a large part of the hickory grown in this country to be used for fuel or other purposes where the exceptional strength properties of this wood are not needed. Usually only a small outer portion of a mature hickory tree contains white wood; the inner part, or heartwood, is red. Many people think that this red wood is not so strong or tough as the white wood. This belief, however, is discredited by actual strength tests made at the Forest Products Laboratory upon many specimens of red and white hickory. The tests show conclusively that, weight for weight, sound hickory has the same strength, toughness, and resistance to shock, regardless of whether it is red, white, or mixed red and white.

The belief that white hickory is superior to red probably arose from the observation that young, rapid-growing hickory trees, which are nearly all sapwood, or white wood, generally have excellent strength properties. As the tree matures, however, this same sapwood is transformed into reddish heartwood; and a half-million tests made at the Forest Products Laboratory have failed to show any change in the strength of wood of any species, due to this natural change from sapwood into heartwood.

A reliable indication of the strength of hickory is its density. That is to say, of two pieces of the same size and dryness, the heavier will be found to have the better strength properties. This fact makes it possible for large manufacturers or purchasers of hickory handles or wheel spokes to inspect the pieces by weight very rapidly and at small expense with automatic machinery.

The man who is buying only one handle will usually find a visual method of judging hickory more convenient and practical than weighing. A fairly reliable visual guide to strength is found in the proportion of summerwood appearing on the end of the piece. The summerwood is the solid-looking or less porous portion of each yearly growth ring. It is quite easy to distinguish from the springwood portion of the ring, which is full of pores or small holes. The summerwood has much greater strength than the springwood, because it contains more wood substance per unit volume. Wide bands of summerwood and relatively narrow bands of springwood, therefore, indicate a stronger piece of hickory than bands of summerwood and springwood of nearly the same width. The greater the proportion of summerwood in a tool handle or other piece of hickory, the greater will be its strength.

The number of growth rings per inch also affords some means of grading hickory. Few growth rings per inch, as shown on the end of a handle, indicate a stronger and tougher piece than many rings, provided, of course, that it is straight-grained and free from defects at important points. Acceptable handles commonly show not more than 20 rings per inch, although much good hickory will be found with as many as 40 rings per inch. More careful inspection, however, by weight, is recommended for this very slow growth material.

As a further guide in choosing a good tool handle, it is worthy of note that the best hickory shows an oily or glossy side-grain surface when smoothly finished; also, when it is dropped on end on a hard surface, such as a concrete floor, it emits a clear, ringing tone, in comparison with the dull sound produced by hickory of inferior quality.

The adoption by the general public of these methods of grading hickory, in place of the worthless prejudice with respect to color, would put an end to the wasteful practice of culling red hickory stock. When hickory was plentiful, this was a matter of seemingly little importance; but now every means should be taken to conserve the waning supply of an important wood, for which no satisfactory substitute has been found.

Tending Toward Straight Side Tires in Europe ?

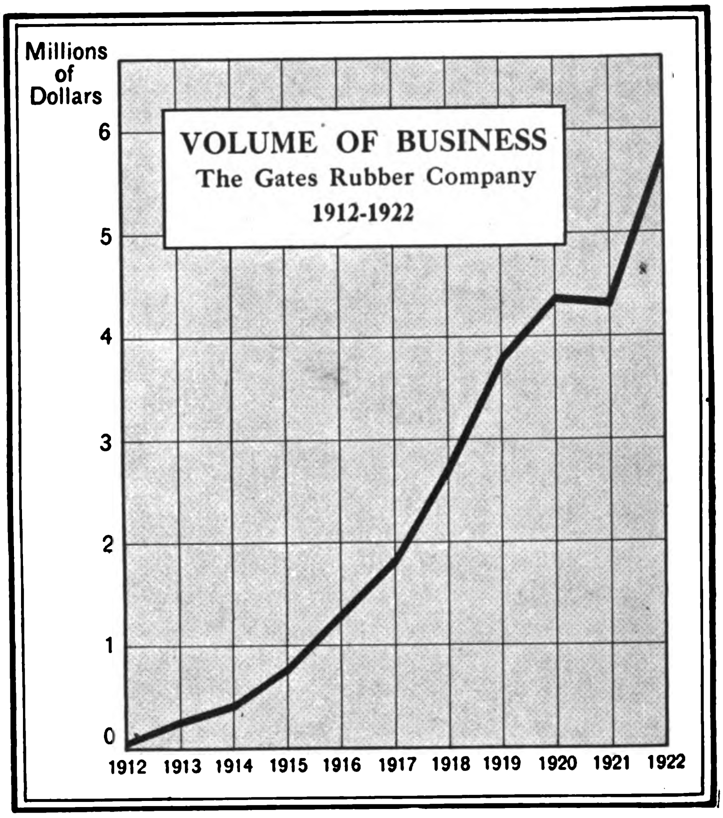
According to the India Rubber Journal of Dec. 9, the tendency is toward the use of straight-side equipment on European cars. The thorough adoption of cord tires in metric sizes by leading European manufacturers is a step in this direction, because of the difficulty of making satisfactory extensible beads for cord casings, and the non-extensible straight side bead is the logical solution. The fact that Rolls Royce has adopted straight-side equipment as standard and that all winners of recent classical road races used straight-sides are additional evidence of the general tendency.

Building an Automobile Accessory Business*

BY CHARLES C. GATES**

How the Simple Process of Seeing Things the Customer's Way Has Built the Gates Business from a $3,500 to a $1,000,000 Concern

WHAT really convinced me of the business value of putting one's self figuratively in the other man's shoes happened a number of years ago. It was back in the period when the importance of horses and automobiles as transportation agencies was about equal, with the horse having a shade the better of it. And we were in it on both sides, with a leather tread to lengthen the life of automobile tires, and with halters which we made from the scrap strips of leather that were left over from making the leather treads.



"OUR BUSINESS IS ONLY 10 YEARS OLD"
Starting with a working capital of $3,500 in 1912, The Gates Rubber Company did a volume close to $6,000,000 in 1922. And this was accomplished, Mr. Gates maintains, "through holding steadfastly to the other fellow's viewpoint."

When we got into selling the halters—they were the result of an idea which came to us after we had been making the leather treads for quite a while—we discovered that we were up against a really stiff selling problem. Pretty nearly every maker of leather products was turning out halters, if not from his scrap, then as a regular line. The price was standardized at about 75 cents apiece; and as far as the user was concerned, a halter was a halter. They were all alike, and all of them were reasonably satisfactory.

In those days Colonel Cody, "Buffalo Bill," made his headquarters in Denver. And while we all have a tendency to think of him as an Indian fighter and subsequently as a circus owner, we then overlook the fact that the Colonel had a real genius for advertising. It was that genius which lifted him into fame from the ranks of all other Indian scouts; and the same gift, applied in his Wild West show business, made him a successful business man. Incidentally the Colonel always had his weather eye cocked for a chance to turn an honest dollar. So to the Colonel I went.

"Colonel Cody," I began, "what kind of halters do you use in your show?"

"Why, just ordinary halters, I guess."

"If I were to give you a few of our halters would you use them?"

"Why, sure I don't see why not."

"All right, then," I told him. "I'll give you a few of our halters, and you can take them out with the show this next trip. If, when you get back, you can give me a good advertising and selling point for the halters, I'll supply you free with halters enough for your whole outfit."

The Colonel agreed, and we sent over a couple of dozen halters. Then I waited until the show returned to Denver. When I called on the Colonel and asked him for a selling point, he stroked his flowing hair for a minute without answering. Then suddenly his face lighted up. "Yes, sir! I'll give you a good one," he declared with enthusiasm. "How's this? We used to have an awful time getting our bronchos out of the cars after a long railroad trip. They got carsick, and wouldn't budge. We didn't dare send a man into the car because he was liable to get himself kicked to death. We used to have to fuss around to get belly slings under those horses, and then haul them out with a block and tackle."

"But since we've had your halters, Mr. Gates, we have found a better way. Those halters are so strong, sir, and now when a horse won't come out of the car, we just stick a pole into the car, with a snap on the end of the pole. We snap that onto the halter ring, hitch the other end of the pole to an elephant, and the elephant hauls that mustang out by main force. That's how strong your halters are!"

Well, the Colonel got the full equipment of halters free. And I developed, with that as a start, a selling plan which was based on the idea that all good business strategy is founded on putting one's self in the other man's position to see just how he will react. I suppose it might be talked about in highly technical and high-sounding terms of psychology. But after all, it is simply common sense applied to the problems that face all business men; and whether the problem is one of reducing manufacturing costs, selling merchandise, or setting a credit policy, I have found that fundamentally the same approach always gets us the best results attainable.

* Reprinted from System, March, 1923, by special editorial arrangement.
** President, the Gates Rubber Co., Denver, Col.

With the "Buffalo Bill" testimonial as a starter, I set myself to figuring a way to distinguish our halters above all the rest of the halters on the market. After a good deal of brain sweat, we arrived at a plan quite different from any we had ever heard of.

Our halter was made of the light-colored leather which is quite generally known as elk-hide. We had found elk-hide was our best leather for the tire protectors; and consequently we decided to make our halters of it. Because others halters were of ordinary dark-tanned leathers, we had a selling point there—it gave us something to talk about.

We worked out an envelope which had rather the appearance of a tag. It was closed by two metal-ringed eyelets; and through the eyelets ran a tape, which was tied to the halter with the hardest of hard knots, the ends of the tape clipped off close so that they could hardly be taken hold of. The whole thing was designed so that it could not be untied except by some one of infinite patience and dexterity.

A Plan to Make the Customer Demonstrate to Himself

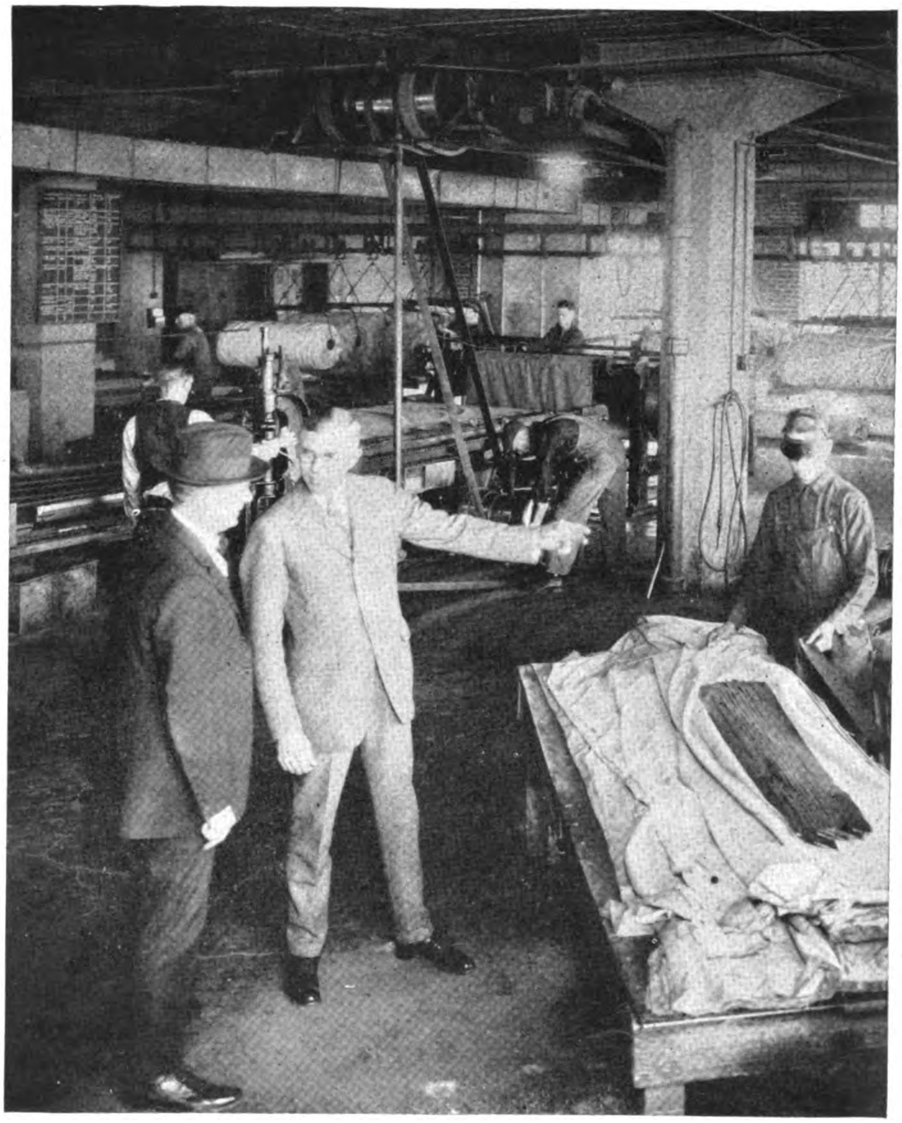
On the envelope was printed briefly the "Buffalo Bill" testimonial, with an illustration of the elephant dragging the balky mustang from the car by a Gates halter which was prominently shown. And then the story went on to explain that this Gates halter was made of leather so strong that even the strongest man could not break with his hands a piece if it no longer than a shoestring; inside the envelope it explained, would be found a piece of this remarkable leather which made so good a halter.

We checked up a good many times to see what happened in a dealer's store where our halter was carried in stock; mind you, you can't expect a country hardware merchant to do much more with any item than simply carry it in stock, even though it is exceptionally profitable to him, and is extra good value to boot. We found that out, for our men first convinced the hardware dealer that ours was the best halter on the market, and then they convinced him that it would be most profitable for him to sell the Gates halter when he could because we had ours priced at $1.25, while the others were 75 cents. And ours carried a little better percentage of profit, as well as the extra profit that came through its higher price. But when the farmer customer came in, something of this sort happened:

"Morning Jim. Let's see some halters."

With a "Good morning, George. There y'are,' the dealer threw onto the counter a handful of halters, representing all the varieties of halters in stock. In that dark, undistinguishable tangle of leather, the light-colored Gates halter stood out like a lighthouse. The customer took hold of the envelope-tag, because there was nothing else of the sort competing for his attention. And he proceeded to read over the text of the envelope, because I may as well admit that it was interesting. When I wrote it, I planned it to be interesting!

After he had read about "Buffalo Bill," and came to the description of how strong the leather inside was, the customer regarded the statement that "even a strong man can't break it," as a direct challenge aimed at himself; farmers are strong men, and they take pride in their strength. So the customer began trying to untie the envelope—mind you, he had not even looked at any of the other halters, so far. And we observed exactly this same thing happen so many times that we came to accept it as standard.



THE RESULTS OF A HABIT OF THOUGHT

"We have found this habit of thought—adapted to the needs of the situation—as mutually advantageous in dealing with employees as in relations with customers. Of course, we have never had any labor trouble. I don't see how we could have." Mr. Gates is the man in the light suit.

However strong farm work may make a man, it does not lend suppleness to his fingers. Finally the farmer got impatient, and jerked the eyelets out of the envelope. Then he eagerly siezed hold of the slim strand of leather, and did his best to break it. He couldn't do that; we were sure of that before we put it in. And he turned to the hardware man and made some such remark as: "Say, Jim, that certainly is strong leather."

"It sure is, George," the dealer would reply with as-

surance, for he had witnessed the same scene a good many times before, and had convinced himself the first few times by tugging at the leather himself.

With that, the customer had finished looking at our halter; he was ready to look at the others. But he found that he could not restore the leather and the envelope to the Gates halter, because he had torn out the tape instead of untying it. He was sold, anyway, on the fact that ours was a fine halter; so he turned to the dealer and asked, "How much is this halter?"

THE "PRODUCTION DIVIDEND"
"In not one of our manufacturing departments has the production dividend fallen below 8 percent."

"A dollar and a quarter."

"Hm. That's kinda high. But it's a good halter, and I guess it's worth it." And with that the customer would tuck the Gates halter under his arm and go his way satisfied.

Then, the next time when he came back to the store for a halter, he saw the Gates halter conspicuous among the rest, he bought it because the old one was giving good service. Because the customer had sold himself on it, with his own hands and eyes in the first place, he was always sure that that was a better halter than any he had ever had before.

Perhaps it seems that I have gone into altogether too much detail describing this little selling plan. But the importance of the basic idea in it may be sensed when I tell you that within three years we were the biggest manufacturers of halters in the United States, which probably meant the world. That little selling knack, because it was built step by step by putting ourselves in the customer's position and working out his reaction throughout, made a by-product side-line into a world leader.

That is all history now. We have been out of the halter business for years, because we chose the path that led up along with the growth of the automotive industry, instead of down with the decline of the horse. But the principle that was illustrated by that incident has been the guiding principle in building a business which today is at least reasonably successful. Every step that we have made ahead has been because we first took the step, in imagination, by putting on the other man's shoes. When we saw how the step would go with him, we knew exactly what would result. And when one can be sure of the result, he goes ahead fast and confidently.

Twice, because we projected our thoughts of the customer beyond the immediate present, we have changed our products so radically as to amount to swapping horses in mid-stream. The first came when we discovered that we could make a rubber "half-sole" for worn tires which would be better than the leather tread which the company had been originally organized to manufacture. The second "swap" came when, finding the market for "half-soles" suddenly gone to pieces as the depression arrived, and simultaneously finding that our new tire design on which we had been experimenting and improving for several years was at last finished, we abruptly ceased making the half-sole line which had been profitable right up to that time, and swung our whole capacity to making tires.

Meanwhile, by the same general method of planning, we had developed two other lines. During the era of the halter business, we had found it possible to make some of our scrap into fan belts for automobiles. Then as we began working in rubber we perfected a rubber-composition belt. Within the last year and a half we have gone into the manufacture of automobile radiator hose, and are already finding a worthwhile volume in it.

The tire which we developed and to which we swung our production in 1920 has this distinctive feature; it has a tread which is both wider and thicker than that of the usual tire. This costs only the additional value of the rubber that forms the extra size; it makes, we know from experience, a better tire. And it gives us a demonstrable selling point, which is about the hardest thing to find in a staple line such as tires.

It might just as well be admitted right here that the lay buyer of tires does not know anything at all about how to judge the value of any make of tire, except by the "buy it and try it" plan. No one short of an engineer experienced in tire design can look at a tire, or even a cross section of a shoe, and say, "This is a good tire," or "This is a poor tire." Judging tire quality is not so easy as that.

Yet the average automobile owner feels the rubber, looks owlishly at the cross sections shown him, rubs a sample of the fabric between his thumb and forefinger, and generally acts in the same way as a man trying to impress his tailor with his ability to judge woolens. Meanwhile, he is listening to the selling talk with one ear, and he finally buys the tire if he came in intending to buy, or he finally buys the tire if he came in intending to buy, or if the sales talk has been good enough to filter through his division of attention.

MAKING IT EASIER TO SELL
Dealers like time-saving selling helps—a specification chart proved to be a good one.

It is possible that you are altogether unacquainted with Gates tires. If so, that is doubtlessly because you happen to live east of the Mississippi river, and because you have never had them called particularly to your attention. We have never been able to manufacture enough tires, since we started, to enable us to go after business east of the Mississippi in a wholehearted way. But west to the coast, we and our product are favorably known. I add this in order that you may not think that the selling point method I am going to describe is devised to cover weaknesses, and so that you may know that we are building as solidly as possible for the future as well as the present.

To return, however, to the tire customer. What we

our branch salesmen to get the customer out of a shopping frame of mind, and ready to purchase; we give them a good talk to deliver about the "wider and thicker tread." And then we supply some stage proptries which, while they really are exhibits of the quality of our tire, serve mainly the end of holding the customer's attention focussed on something the salesman can talk about.

One of these is a small ball made of pure rubber tread stock. If you have never had much to do with rubber stock of this kind, you have no idea how the stuff bounces. A friend, sitting by my desk, recently, took a tiny strip which he had picked up in the factory, and tossed it into a waste basket not two feet from his hand. To his astonishment it rebounded clear out of the basket, and came to rest perhaps four feet away. That is the stuff these balls are made of. The salesman, explaining to the customer the quality of rubber that is in our tires, suddenly hands him the ball. "Bounce it," he directs. And the customer, giving it a little toss to the floor, may see the ball bounce all the way up to a 10-foot ceiling. He is impressed.

"That's a sample of the rubber Gates tires are made of," the salesman assures him—and the customer is always impressed.

Similarly, there is attached to each tire in an envelope a strip of tread rubber, with directions for stretching it. It is really an adaptation of the elk-hide stunt that sold halters for us years ago. The customer stretches this fragile-looking strip, and is astounded at the stretch and the tensile strength it has. It impresses him with its high quality, and the value of the extra rubber in the "wider and thicker tread" appeals to him as a matter of vital importance—as it really is, though ordinary methods would not impress this on the customer.

Almost always, this display of the qualities of the rubber in the tires makes the sale. Actually the customer does not know much about the quality of the tire as yet; if we were making a poor tire, he would be convinced against the facts. But with the best quality in our tires that we know how to put in, we are content to leave the re-order question to the performance of the product.

If we tried to train the salesmen to talk ordinary technical advantages of a tire that did not have so obvious and apparent an advantage as the wider, thicker tread, we should have to confine our representation to graduate engineers. And I believe that no one could understand their talks who had not had similar educational advantages.

As it is, approaching the sales problem from the point of view of "How will it affect the customer?" we have built up a sales volume which taxes our production to the limit.

We went after the fan belt business by somewhat the same sort of commonsense approach. The business was almost entirely in the hands of the factory branches and agencies of the automobile manufacturers, because each model of each machine had to have its own special dimensions of fan belt. Carrying anywhere near a complete stock of belts for every model of every machine was a quite hopeless job for jobber or retailer.

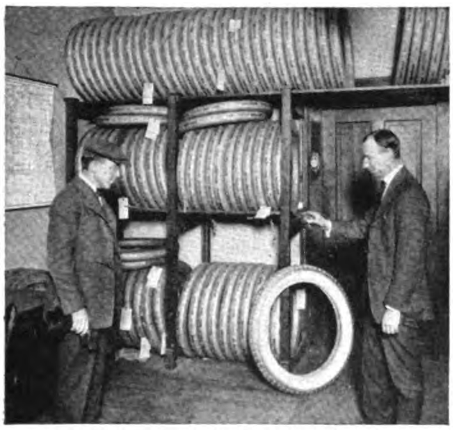
We saw that the retailer and the jobber would like to have this additional volume if there were some way it could be brought within reasonable limits of variation. By getting measurements or specifications on all the more common classes, we found that some 20 varieties of specifications would handle approximately 95 percent of all the demands that would come to the dealer.

So we began manufacturing those sizes, and supplied the dealer with a chart which shows him that, for example, a 1918 Dodge requires a number 835 in our line of belts. Perhaps twenty-odd other automobile models use the same belt; the dealer, looking up one of those other models when a customer calls for it, supplies a belt of the same stock number. And while dealers and jobbers cheerfully handle our line of fan belts for the profit it brings, the familiarity of the automobile owning public with the brand has resulted in a large number of manufacturers adapting our belts as standard equipment. We now, as a result, make more fan belts than all the other fan belt manufacturers put together.

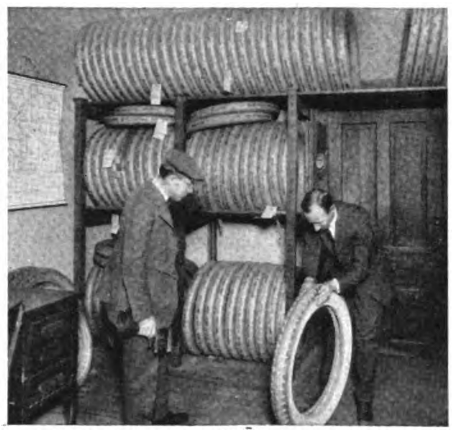
And then there is the radiator hose. All hose manufacturers sold it to automobile makers. Some of them used odd ends, and lengths of hose which had imperfections. The flaws could be cut out and the rest cut up into the short lengths required for the purpose.

Here was another line the dealer could hardly afford to carry. Several diameters of hose are in use for the purpose. And when a customer came in to get his old hose replaced, the dealer had to hunt up a rule, burrow into the "innards" of the car, take the measurements, both as to diameter and length, and then measure off perhaps 3½ inches of hose from the length. He frequently got grease

(Continued on Page 26)



A DEMONSTRATION IDEA
Every dealer has been supplied with a small rubber ball made of tread stock for demonstration purposes.



THIS MAKES SALES
Selling points are planned carefully—the wide and thick tread was found to clinch many a sale.

A CONVINCING TEST
Stretching a strip of tread rubber was found to convince the customer of high quality.

The Automotive Manufacturer

A consolidation of The Hub and Automotive Engineering

Published monthly by

THE TRADE NEWS PUBLISHING CO.

Heptagon Building, 153 Waverly Place, New York City

PAUL MORSE RICHARDS, *President* G. A. TANNER, *Secretary and Treasurer*

MORRIS A. HALL, Editor

SUBSCRIPTION RATES

United States and Mexico, one year	$2.00
Canada, one year	2.50
Foreign countries	3.00

Remittances at risk of subscriber unless by registered letter, or by draft, check, express or post office order, payable to The Trade News Publishing Co.

THE AUTOMOTIVE MANUFACTURER, a consolidation of THE HUB, established in 1858, and AUTOMOTIVE ENGINEERING, established in 1916, is an authoritative journal, presenting everything entering into the construction of automotive vehicles which is new or worthy of consideration by automotive engineers and manufacturers.

Vol. LXIV MARCH, 1923 No. 12

Topics of the Day

ONE of the topics of the day, wherever business men and manufacturers congregate, is the continued upward swing of metal prices. Steel is many dollars a ton above its price of a year ago, pig iron is up about $3 a ton, the finer steels are up many cents a pound. Copper which went begging at this time last year at less than 12 cents is now about 17, export copper is quoted at close to 18, and the price is continually tending upwards. Lead is nearly twice its price of a year ago; babbitt and bearing metals are up on the same basis, and all the other nonferrous metals have moved up a considerable amount.

These price increases are not restricted to metals, for rubber had undergone a tremendous advance, reaching 37 cents on Jan. 24th, which price was only 200 percent above the 1922 low level of 13 cents, reached in the early months of 1922. Since the former date, it has constantly tended upwards. Oil production has started its customary upward spring swing, and predictions are rife that we will pay unprecedented prices for gasoline this summer.

Just how does all this affect the automotive manufacturers. The rise in metals is of direct and immediate concern, for beyond a small amount of metal which large companies, like Ford and General Motors might have in storage, all manufacturers must pay more for the materials which enter into the construction of cars, trucks and tractors. Most of the metals mentioned are used in more or less large quantities. Thus, it is estimated that this year's cars and trucks will call for 120,000,000 pounds of copper, while accessories and parts not included in this total will need 5,000,000 to 15,000,000 pounds.

With raw materials up, parts up, tires up, labor wages high as ever, the margin for the automotive manufacturer, at least in the highly competitive groups, has become too narrow for comfort. Under this rising tide of prices, coupled with the most unusual winter months' demand ever known, it is not strange that vehicle manufacturers are planning to increase car prices.

As this is written (mid-March) Hupmobile and General Motors have announced that their prices will be increased on April 1st. In addition, Studebaker and several others are known to be planning to follow these examples. These will affect the entire list of motor cars below $3,000, so that another shifting of the whole price list may be expected shortly.

In the face of these disturbing elements, the industry has been experiencing the pleasant sensations of the best January, the best February and the best March it has ever known. With March already holding up to the expectations that it would exceed by a substantial margin March of last year, when 172,720 cars and trucks were made and sold, it appears certain that the year's first quarter will show double the sales of the first quarter of 1922.

The very high production records which some of the companies are making will bring with them new simplifications of design and construction. There appears to be a continued tendency toward aluminum and the lighter alloys. With lighter chassis receiving attention and new lighter bodies being produced, it is not strange that light weight on the one hand and bodies on the other are receiving unusual attention. Enclosed bodies are in very strong demand, so strong that a shortage before summer is now predicted. Many makers are approaching a 60-40 basis, 60 enclosed, 40 open. It looks like a good year.

Year Opens Auspiciously

PROPHECIES which were regarded as somewhat wild when made near the end of the year, and with reference to the possible output of cars for 1923, now appear to have been based on very sound judgment, if indeed, later developments do not prove them to have been conservative.

In February, not usually a good month, the output of the manufacturers reporting to the National Automobile Chamber of Commerce, which does not include Ford of course, was 270,995. This as it happens was the third largest output, being exceeded only by two months of 1922, namely June with 289,011 (the record) and August with 272,538. It will be noted that the margin of lag behind the latter month is very small, which is surprising when one considers that it is supposedly one of the best months of the year while February is generally ranked as one of the poorest.

This condition of large sales presages unusual sales when the big months come along, and the plans of all the larger companies reflect this. Chandler reports that it has practically reached the capacity of its factory, namely 100 cars a day (at an annual rate of 30,000) but that it is attempting to speed up deliveries of parts and accessories in hopes of reaching 120 cars a day, during April.

Maxwell has been ahead of its schedule all year, the January figures being 3,500, February 4,000, while March production schedule calls for 5,250. Present indications are that the latter figure will be exceeded.

Other companies report the same thing, unusual buying demand, and very large orders placed ahead so that no sign of a let-up is seen for months to come. All of this spells an unsually good automotive year all around, and some new production records. The February figure is at the rate of 3,250,000 a year, while the most optimistic predictions to date have been three million or less.

Detection, Location and Comparison of Sound--II

B. C. E. NOEL-STORR*

Methods by Which Sound Has Been Measured in Past Not Now Sufficiently Thorough — Scale of Noise or Lack of It Needed—The Tectoscope

To carry the matter a step further, it may be desired to know to what extent the pistons of the former example differ as regards "slap," and although with the dual reproducer the operator can determine the order in which they fall below the best example, he has no means of measuring the amount of the difference. To meet this case the reproducers are arranged as in Fig. 3, the damping valves being located between each reproducer and the head frame. The valve arrangement is fairly simple, since the pointer is arranged to work over a scale which can, if desired, be set for a given number of degrees in either direction. The difficulty in the former case was to devise any form of valve sensitive to small amounts of sound, but as the present valves are only required to reduce the sound slightly, there has been no further difficulty on this account.

In operation, the valves are required only to reduce the maximum sounds to equal intensity with the other sounds. Thus to take the case of piston "slap," the method would be as follows: The reproducers having been applied either by hand or in clamp brackets to the respective cylinders, the operator closes the valve on the right-hand side, and

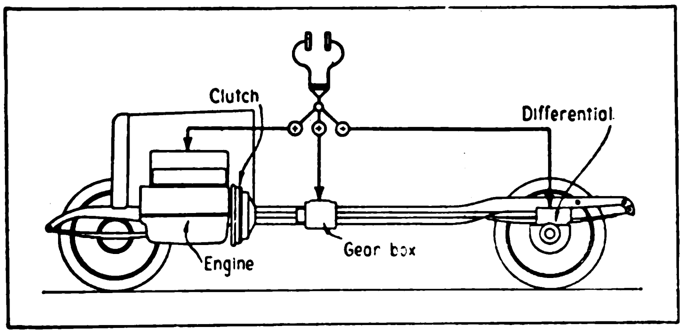


Fig. 4. Diagram illustrating general tests on chassis.

with the left-hand valve full open notes the sound of a particular cylinder. The right-hand valve is then slowly opened, and should the sound be found to be equal to that on the other side before the valve is fully opened it is evident that the right-hand side is connected to the worst cylinder, in which case the degree of difference can be read directly from the scale, and will be found sufficiently accurate for most purposes. Conversely, if the right-hand valve can be opened fully, and the sound still remains fainter than that emitted from the left side, it is evident that the right hand is the better cylinder, and the left hand valve should be closed down to obtain the degree of difference.

The fact that the operator may have defective hearing on one side of the head is of no moment, since the sounds are superimposed and conducted equally to both ears. In fact, the test could be made quite well if the operator were perfectly deaf on one side of the head, while the valve scale readings may be made to agree by leaving one valve entirely shut and applying the other instrument to a watch, gradually closing the valve and setting the scale to agree with the pointer position at a given number of degrees. The same process should then be repeated with the other instrument, taking care that the scale is set at the same number of degrees and that the valve of the instrument, not being set, is fully closed and the instrument clear of the table or bench.

It may perhaps be argued that the method of obtaining the difference is approximate only, and this is to some extent true. If, however, a moment's consideration be given to the method, it will be seen that even without the valves in use it is quite simple for a careful operator to detect very minute differences when it is a case of simply comparing two sounds, and when the valves are used to obtain a balance between the two sounds the relative accuracy obtainable is increased.

The final step towards the standardization of the sound of components consists in comparing each unit either with a checked and corrected standard part running under ideal conditions, or to some form of mechanical sounder designed to produce a given amount of interference, sufficient exactly to drown the sound of the part being tested if this is correct. Should the test part, however, be more noisy than usual, the sounder will fail entirely to drown the sound, and the part may be rejected.

In this connection there seems to be a difference of opinion as to whether the sound of the standard should be just audible when tested against a good component, or whether the component should be just heard above the sound of the standard. The personal opinion of the author is that it is better to have matters so arranged that the test part is only just heard over the standard. If clearly heard, however, a certain amount of tolerance can be given by using the damping valves and permitting the valve on the test side to be closed not more than a few degrees

From the results obtained during the last year it would appear that for the present at least only slight commercial interest is taken in the matter of standardization, possibly due to the fact that, provided components are checked as outlined above by the simple comparison with dual reproducers, excellent results can be obtained. It may also be partly due to the fact that the use of the valves may appear complicated unless a trial has been made, but in point of fact no difficulty appears to have been experienced in the actual use of the valves, even by persons with only a slight experience of the instrument.

The general scope of the instrument having been outlined, a few details of what may be called general automobile applications may be of service.

Some Specific Automobile Applications

Taking first the engine on the test bench, the diagram (Fig. 1) gives application points for the test rod to such main components as can be clearly shown. For instance, it may be found that there is considerable external noise from the tappet head and valve stem, H, although the cam and tappet action, A, is reasonably quiet. This may be still further increased by an unsuitable form of valve cover

*Managing Director of the Capac Co., Ltd., London. A paper presented to the Coventry Branch, Inst. of Production Engineers.

plate, while another point which may be noticed is that the closing of the inlet valve is very frequently more noisy than that of the exhaust. In such cases an injection of oil through the carburetor intake will tend to show that the noise can be prevented by an oily or dirty seating.

On the gear bench, the checking of the running condition of ball journals after fitting will avoid subsequent trouble, owing to the outer race having been contracted in fitting, or possibly where there are two bearings close together, to incorrect alignment or end thrust; the same remarks apply with equal force to the rear axle, and it is hardly necessary to give details of this work.

For both the preliminary and final testing, some form of instrument appears to be essential, as with increased demands for silence and efficiency, corresponding advances must be made in methods of testing. In some cases the rough test is carried out with three instruments attached to the engine, gear box and rear axle respectively, as shown in Fig. 4, a triple valve being so arranged that any one unit can be taken at a time.

Possibly for many cars it would be sufficient to arrange for the testers to have access to the instruments in the running shed, and it may be advisable to select one or two men to specialize on the tracing of sounds.

Many sources of trouble in closed body work can be easily obviated with the aid of the tectophone, which will trace body squeaks, panel drumming, and the periodic drumming of wings, undershields, and valances, under actual running conditions on the road. It is probable that in this one section alone, very considerable saving in time and material could be made after a series of short tests with the instrument, and the possibility of obtaining a reasonably silent body becomes more or less a practical proposition.

In this paper general applications only have been considered, but it was considered that from these average tests the engineer would be able to deduce the possible advantages in connection with the particular problem with which he happened to be concerned at the moment.

The instruments described have certainly given good results, but in common with all mechanical devices there is always room for improvement both in construction and in methods of application. It is hoped, therefore, that suggestions and views dealing with both the construction and use of the device will be given, and the author would be glad of any suggestions tending to improve the instrument as applied to production problems in particular.

This paper would not be complete without general reference to other systems for detecting, locating and comparing sounds, and since each system has its useful points it may be desirable to consider the instruments in three distinct classes.

The specific application for which any particular type of instrument is suitable will in the majority of cases be apparent, though it should be mentioned that there are certain instances where it is advantageous to employ an instrument which on the surface does not appear to be the most suitable for the work in hand.

Possibly the best example of this series is the system devised by J. Gardner, and briefly the method adopted is the attachment of suitable microphones to the parts it is desired to test, these being connected on similar lines to the well-known inter-communication telephone. This system lends itself to convenient arrangements, and if desired the receiving telephone may be in a silence cabinet. The switchboard is fitted with the requisite number of contact positions, and as the circuit can be changed from one point to another in a few seconds it is claimed that the comparison of any two sounds can be made efficiently.

In operation for marine work or in a power station the important bearings, cylinder heads, pumps, and so on, would each be permanently fitted with a special microphone, and this would be in turn connected to the telephone switchboard under a given number.

The engineer-in-charge could then ascertain the running condition of any particular part of the plant and thereby check the possible development of any lubrication trouble or mechanical defect, as in this type of station the engineer would be in telephonic communication with the person in charge of each section.

In effect the system is not unlike central control of furnaces by grouped pyrometers, and the sphere of usefulness appears to be confined to fairly large and extensive plant, with perhaps special reference to the control of marine engines.

There is also a simple application of a similar device called the detectorphone, although the author has been unable to trace the name of either the inventor or manufacturer. The instrument appears to consist of a small sensitive microphone arranged with a dry battery in the enlarged handle, and from the available details it would appear that the sound of the part is simply reproduced through a microphone and then rendered as an increased atmospheric sound, the purpose being to detect very small mechanical sounds.

The best known example of this type is the audiometer of Prof. Low, in which the sound causes a sensitive diaphragm to reflect a pencil of light on to a photographic film. Investigations may thus be conducted by comparing the record of the part tested with the record of a sound of known intensity and volume.

In application, however, the instrument would appear to require expert handling, and the film, of course, requires development before the record is available. At the same time the instrument can be used for visual examination, the light then being projected on to a screen in place of the film, although in this case no record remains for future reference.

The scope of such instruments is obviously large, but the application is rather in the nature of a laboratory undertaking and for accurate experimental work in general as compared with the permanent application of the electrical system first mentioned.

The third system and the one in which the author is most interested combines some of the advantages of both the previous methods with at the same time lower first cost and without the necessity for skilled operation or attention.

From the details already given of this system it will be seen that the basic idea is similar to that underlying the well-known medical application, and the system may therefore be termed the stethoscopic system.

These three methods of detecting, locating, and comparing sounds would appear to cover the commercial applications up to the present time, and in view of the increased interest which is now being taken regarding sound, it is hoped that perhaps this paper may bring the subject before engineers, who previously have not troubled to give the matter serious consideration in connection with the many problems of efficient production.

Body Noises

The noises which are set up in bodywork may generally be traced to some loose part, but, as most of the materials used will set up and transmit sound, vibrations may be caused by the particular way in which the body is constructed. The drumming roof was a continual source of annoyance with the horsed carriage, and the problem reappears from time to time. Some owners of limousines, saloons, and other types of closed bodies, complain of the mysterious noises which are set up inside the car while it is in motion.

Although a well-domed all-metal roof will set up more noise than a flat wooden one made with stout hoopsticks and substantial roof boards, the real seat of the trouble lies in the continuity of surface. For this reason a roof ventilator is of great value for maintaining the silence of the roof, or it may be constructed so that the wood or metal used does not form an unbroken surface, two or three slits or spaces being left which can be covered on the outside with the moleskin or other material used, which will be concealed on the inside by the roof lining. It has also been found that painting both the inside as well as the outside of the roof with two or three coats of ordinary filling-up is an effective means of damping out roof vibrations, but why it does so has not yet been explained. Drumming of the roof is also set up by the engine occasionally. This is owing to a want of balance in the reciprocating parts, which may be in itself quite trifling, but at certain engine speeds, this fault will develop a marked period of vibration.

The method adopted for mounting the body on the chassis may set up unpleasant creakings. Felt and rubber pads have been advocated as a means of isolating the body, not only from the transmission of sound but from shock also. There is no theoretical disadvantage, however, in the wooden bottom side lying directly on the metal chassis frame. The trouble arises when strains are put upon the body owing to one side of the chassis being deflected more than the other. This may happen when the car is being driven over bad roads, or the defect may arise after the car has been allowed to stand for an hour or so on uneven ground.

A body should be attached to the chassis in as few a number of places as is consistent with safety, also there should be no rigid connection between the front of the scuttle and the dashboard, a method of construction which has been in use for many years but is by no means universally adopted. Wings, valences, and inside shields will rattle if they are of too light a gauge, or if they are insufficiently supported or inadequately fastened. A wing stay should always be bolted up to the wing with a strip of leather between, and also between the flap of the stay and the chassis. Also, bearing in mind the amount of vibration which is set up close to the front wings, lock-nuts should be used, or any other device which prevents movement. The use of a leather or rubber pad between the top of the hind wing and the undersurface of the wheelarch will ensure that no noise is set up at this part of the body should there be any relative movement between the body and the wings.

Door silence depends on many factors, but as it is a hinged structure and provided with a slam lock, it cannot be expected to remain in perfect order indefinitely without any attention. A well-hung door made up of the best materials and fittings, however, will stand up for many thousands of miles of travel before sufficient play is set up to cause even the slightest degree of annoyance. The door must not only be made of seasoned material, but the pillars should be cut from the plank so that any slight tendency to alter in shape is outwards at the lock bearing; also it must be fitted into a framework which itself is of dry stuff. The bolt of the lock and its striking plate should be of ample proportions. Various forms of door silencers are on the market, while a useful invention for eliminating door rattle is the adjustable striking plate which allows any play which may develop to be taken up as required.

Perhaps the chief source of noise in the motor body of a few years since was the glass frames which became loose in the runs, or the glass was not tightly held in the frames. In order to cure the loose glass frame, many patterns of window silencers were available, but, now that the frameless light running in velvet-lined channel is so popular, this part of the car is seldom much cause for complaint as a source of rattling, unless the parts have become worn or are badly fitted. Where the glass is bedded in rubber as in a windscreen, the strip is preferable to the channel, since the glass may work through the bottom of this in the course of time and so produce looseness.

Floorboards which are made to take out for inspection purposes should fit tightly. In a high-class body they should be made up with framed ends, so as to preserve their shape. In a large body, when designing a trap door for inspection purposes, it will often be found possible to hinge it and fasten it by a good catch. Noise may be set up by badly packed tools, which is no fault of the body-builder, but when he is building a body he should mention this possibility, so that he may provide suitable receptacles, especially if it is a closed car. Body noises set up in open types of bodies are less noticeable, as there is more chance for the air currents carrying the sound away. If the body is not firmly bolted down or clipped to the frame, a thump will develop when the car is running over uneven ground. The doors are, on the whole, more liable to work loose on a touring car than on a limousine, since the standing pillars are not so well supported in the open car, and the motorist is often tempted to lean on the door when entering or leaving the car. The cape hood may also be a source of annoyance if it cannot be firmly strapped down when not in use, while, when it is up, care should be taken to ensure that there is no chattering set up between the bows or fittings and the windscreen, or the front fastening, and the wings or any part of the chassis.—Automobile & Carriage Builders' Journal (London).

British Auto Foreign Trade in November

British imports of passenger cars and trucks during November showed little effects of the slack season, the total of 1,861, valued at £355,285, being a slight gain over the 1,797, valued at £315,237, imported during October. As usual, complete passenger cars accounted for over 60 percent, both in number and value, 1,132 of the number being valued at £237,427. The average c.i.f. value, almost £210, was the highest for several months, the corresponding figures for October and September having been £179 and £166, respectively. Undoubtedly this increased value was due to the higher priced models imported for the annual motor show held the first part of the month.

Tractors on Southern Farms

By H. R. TOLLEY* and L. M. CHURCH**

Pointers for Manufacturers of Motor Tractors from the Experience of Users — Possible Demand and Future Sales—Costs—Repairs—Work Done and Days Used Each Year

(CONTINUED FROM PAGE 27, FEBRUARY ISSUE)

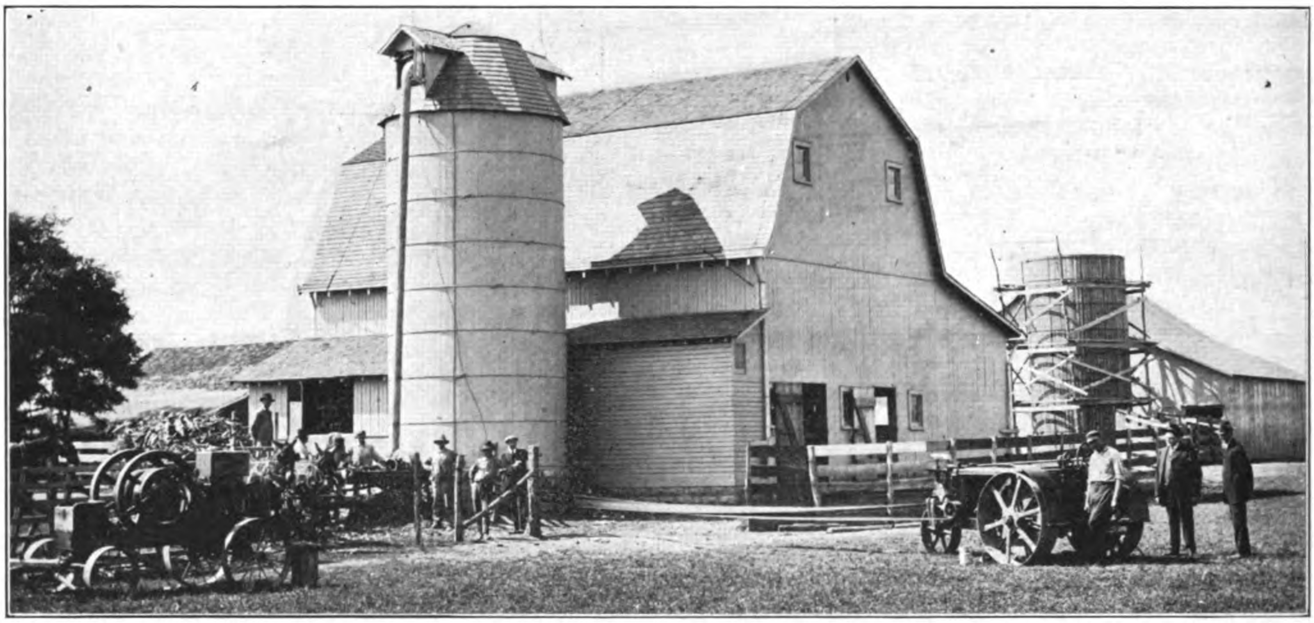
FIRST cost of tractors and the special machines which were purchased for use with them averaged approximately $1,400. On many of the farms the cost of the tractor outfit was no doubt greater than the investment in all other machinery. On the average, the first cost of the tractor alone with freight was $1,050, the average cost of the 2-plow machines having been $947, and of the 3-plow machines $1,385. All these tractors had been purchased in 1918, 1919 or 1920, and at present (April, 1922) the average prices of tractors or similar sizes and types are something like two-thirds of these figures.

Practically every farmer purchased a special plow for use with his tractor. Disk plows are used more commonly in this section than in any other part of the country, and 79 percent of these farmers used disk plows with their machines, while the remainder used moldboard plows. The average cost of the 2-bottom disk plows was $188 and of the 2-bottom moldboard plows $155. The average cost of the 3-bottom disk plows was $227 and of the 3-bottom moldboard plows $228. For all farms the average cost of the tractor plow was $191.

About 90 percent of these men had purchased some other machinery in addition to plows for use with their tractors at an average cost of a little over $200. Many had purchased heavy tandem disk harrows designed especially for tractor use, and a considerable number had added one or more belt machines to their equipment after purchasing their tractors. As in the case of the tractors, the cost of the plows and other equipment if purchased at the present time would be somewhat less than the figures shown.

In order to determine the number of years of service which tractors will give under southern conditions, and their rate of depreciation each man was asked to estimate the number of years of satisfactory service which he believed his tractor was capable of performing. While none of these tractors had been in use more than three years at the time the reports were made, and most of them were not nearly worn out, the average of the estimates gives the best available figure for the life of a tractor under actual farm conditions, and the first cost divided by the average life the best available approximation to the annual charge for depreciation.

According to the estimates the average life of all tractors would be 7.6 years, and the annual depreciation would be $138. The estimated life of the 2-plow tractors was 7.4 years, and the annual depreciation $128. The estimated life of the 3-plow tractors was 8.0 years, and the annual depreciation was $173.



Using the tractor for cutting silage and filling the silo, an everyday farm scene.

It must be remembered, of course, that the future life of a tractor, as of any other machine, depends not only upon its present condition and the probable amount of work which it will be required to do but also upon the care which it will be given and its owner's idea as to when it will be more profitable to discard it than to spend more time and money for repairs.

Those who gave unfavorable reports on their machines estimated the total life at an average of 5.1 years, while the men who gave favorable reports on their machines estimated their life at an average of 8 years. Thus it would seem that a prospective purchaser would be safe on counting on a minimum of 5 years' service from a tractor, and

that one of good construction and workmanship, if given intelligent care and kept in repair, should last 8 years or more.

Repairs

Since none of these tractors are nearly worn out the expense of repairs for them up to the time the reports were made does not give a true indication of the repair costs for the entire life of the machines. However, in order to determine the approximate repair costs during the early years of the machine's life each farmer was asked how much he had spent for repairs from the time of purchase to the time he made his report.

Nearly one-third of those who had owned their machines one year or less had had no expense for repairs. Some of the others had had heavy repair charges, however, so that the average repair costs on all 2-plow macines which had been owned one year or less was $28, and on all 3-plow machines, $21. There had been no repair costs on a little less than 10 percent of the machines, which had been in use between one and two years. The average repair costs on all 2-plow machines in this age group had been $48, and on 3-plow machines $65.

Eighty-seven owners of 2-plow machines which had been in use between two and three years reported an average repair charge of $87 to date, and 22 owners of 3-plow machines of the same age reported an average repair charge of $111.

These older machines had been in use approximately two and one-half years on the average, and thus the average annual repair costs had been about $35 for the 2-plow machines and $44 for the 3-plow machines It is apparent, however, that these figures are too low for the annual repair charges covering the entire life of the machines, and in the computation of the cost of using these tractors the average annual repair charges have been assumed to be 4 percent of the reported first cost; that is, $38 per year for the 2-plow tractors and $55 for the 3-plow tractors.

In order to determine the character of the service which the tractor owners in this section could expect from the manufacturer or the dealer, these men were asked to report the amount of time which they had lost on account of inability to obtain repairs when needed, and the character of the work done by expert repair men. About 60 percent of them stated that they had suffered no delays while waiting for repair parts, but the remaining 40 percent had lost an average of about 9 days on this account since their machines were purchased.

Since tractors did not come into general use in the southern states until a comparatively late date, some manufacturers and dealers are evidently not so well equipped to furnish repairs and service on their machines as they are in other parts of the country.

About two-thirds of the entire number had utilized the service of an expert repair man at least once, and in about 85 percent of the cases the owners considered that the work of the experts had been satisfactory.

A prospective purchaser will want to guard against the possible loss of several days' time during the busy season, and the troubles due to poor work of socalled expert repair men, consequently he should satisfy himself that he will always be able to obtain without delay any needed repairs for the tractor which he intends to purchase, and that a competent repair man will be available if needed.

Days Used Annually

The number of days' work which a particular tractor will do in a year depends in a large measure upon the system of farming followed, the size of the farm, and the particular operations for which the owner uses his machine. The prospective purchaser will desire to know, however, about how many day's work per year he should expect his tractor to do, and these tractor owners were asked for their estimate of the total number of full day's work done per year by their machines. The average of the estimates was 53 days.

As would be expected, those who were operating larger farms use their tractors a somewhat greater number of days per year than those who used them on the smaller farms. The men whose farms were less than 175 acres in size estimated that they used their tractors on an average 48 days per year, and those whose farms contained 175 acres or more estimated that they used their machines 56 days per year.

The average size of the farms on which the 2-plow tractors are owned is less than those upon which the 3-plow tractors are owned, and while the 3-plow machines do more work per day than the smaller ones the owners of the 2-plow tractors estimated that they used them only 52 days annually, while the owner of the 3-plow machines estimated they used them 56 days.

The life of a tractor depends to a certain extent upon the amount of work it does. Machines which do the least amount of work per year, should, in general, have the longest life in years. As stated above the estimated life of all these tractors was 7.6 years, and if they do 53 days' work per year they will do about 400 full days work during life. While the tractor of high class workmanship, which is always run by a skilled operator, would no doubt have a longer useful life than this, the prospective purchaser should not often count on being able to obtain more than 400 full days' work from his machine.

Work Which Tractors Do

While all of these machines are used primarily for work on the home farm, approximately 50 percent of the owners stated that they did some custom work with their tractors. Thus custom work, however, usually amounted to only a few days per year, and over 90 percent of the time the tractors were used during the year covered by the reports was spent on the home farm.

Drawbar work constituted approximately 80 percent of the work on the home farm and belt work the remaining 20 percent. The tractors were used more for plowing than for any other one operation. For all farms the drawbar work was divided approximately equally between plowing and all other drawbar work, most of which consisted of disking and other work in preparing the seed bed.

On most farms this work of plowing and fitting ground required more time and labor than the other operations, and it is for such work that the tractor is usually most suitable. There may be some question as to whether or not a tractor can be used satisfactorily for the work of fitting the ground after plowing on account of danger of packing the soil and possibly inability of the machine to obtain traction. Most of the men are evidently finding the machine which they own satisfactory for such work. A large majority of the tractors have been used for some

work on plowed ground, and over 90 percent of the owners stated that they considered their machines satisfactory for such work.

A considerable number reported that they used their tractors for pulling binders in grain harvest, but where such work was done with the tractor it amounted to only four or five days per year. About one-fifth of the men also used their tractors for hauling on the road. However, unless very heavy loads are to be hauled comparatively short distances, some other form of power will usually be found preferable for this work.

The men were not asked for a report as to the specific belt operations for which they used their tractors, but, in order to determine whether or not they were finding it possible to use their tractors for belt work which they formerly hired done, each owner was asked to give an estimate of the number of days of belt work now done annually with his tractor which was formerly done with a hired engine. Four hundred and seventy-six of the 684 men replied to this question, and the average of the replies was 13 days. One hundred and three, or a little over 20 percent of the 476, however, said that they do not use their tractors for any belt work which they formerly hired done.

The replies showed that the 2-plow tractors saved the hire of an engine for 12 days annually and the 3-plow machines for 16 days. The average size of the farms on which the 2-plow machines were owned was 262 acres and the 3-plow 402 acres, and there probably was a considerable greater amount of belt work to be done on the larger farms. Also in some cases the lighter 2-plow machines did not have sufficient power for part of the belt work, and the owners of such machines may find it necessary to hire engines to a greater extent than will the owners of more powerful tractors.

Work Done Per Day

A large majority of tractor owners use their machines for plowing, and 519 owners of the 2-plow machines and 131 owners of the 3-plow machines gave statements of the average number of acres covered per day at this operation. As already stated about four-fifths of the plows used with the tractors were disk plows, and on account of their narrower width as compared with moldboard plows the acreage covered per day with such plows was somewhat less than that covered by moldboard plows with the same number of bottoms.

On the average the 2-bottom disk plows covered 4.7 acres per day and the 2-bottom moldboard 5.3 acres, the 3-bottom disk plows 6.5 acres, and the 3-bottom moldboard plows 7.3 acres. Thus, for each size, the moldboard plows covered about one-eighth more ground per day than did the disk plows. When plowing, they were in the field an average of a little less than 10 hours per day.

A comparison of these figures with those determined in investigations of the use of tractors in other parts of the country show that the tractors in the south do not cover quite as great an acreage per day in plowing as do machines of corresponding size in other areas. However, the reduction in the amount of labor required for plowing below that required for plowing with the horse outfits commonly used is at least as great on these southern farms as in any other part of the country. On very few farms in these states are teams of more than two horses or mules used for plowing, and in many cases only one-horse plows are used. A two-horse plow will rarely cover more than 2 acres in a 10-hour day, which is less than one-half of the average acreage covered by the 2-plow tractors and less than one-third of the acreage covered by the 3-plow outfit.

In addition to covering a much greater acreage, the tractors have also made it possible for these men to plow to a considerably greater depth than they did before purchasing their tractors. While every man did not increase the depth of his plowing, the average depth to which they plowed with horses before purchasing their tractors was between 5½ and 5¾ inces, and with their tractors they plow to an average depth of 8¾ inches.

Fuel Requirements

The 2-plow tractors use an average of about 17 gallons of fuel per day for plowing and the 3-plow tractors about 21 gallons. About 80 percent of the 3-plow machines and about 70 percent of the 2-plow machines were operated on kerosene, but inasmuch as the kind of fuel used makes little difference in the amount required per day and per acre, the averages above are for the kerosene and gasoline-burning tractors combined. In addition, however, the kerosene tractors used an average of about a half gallon of gasoline per day for starting and warming up.

There is practically no difference in the amounts of fuel used per day by tractors of the same size pulling disk and moldboard plows, but the greater number of acres covered per day with the moldboard plows makes the average number of gallons per acre less when using the moldboard plows than when using disk plows. The average requirements per acre for the two sizes and the two kinds of plows are as follows:

	Gallons
2-bottom disk plow	3.7
2-bottom moldboard plow	3.1
3-bottom disk plow	3.3
3-bottom moldboard plow	2.9

While these figures are somewhat higher than those usually given by manufacturers and others for the amount of fuel required to plow an acre, it must be remembered that the average depth of the plowing is 8¾ inches, and that much of the soil in the south is heavy. Furthermore, the disk plows commonly used do not turn as wide a furrow as the moldboard plows used with the same tractors in other sections, and consequently more time and travel is necessary to cover a given acreage.

While a careful operator, with a machine which is in perfect adjustment, may be able to plow with less fuel than this the prospective purchaser would not be justified in expecting to be able to do heavy plowing at all times during the life of his tractor with an average fuel consumption much less than that given above.

No figures were obtained upon the amount of fuel used at operations other than plowing, but investigations made in other parts of the country, have shown that when a tractor is pulling a full load either on the drawbar or on the belt the amount of fuel used per day is very nearly the same as when plowing.

(To Be Continued)

The automotive industry of Belgium made a substantial recovery from past depression. The demand for American accessories and parts increased. Large imports took place during the year of low-priced passenger cars and trucks. German vehicles were imported on old contracts which are expected to be cancelled.

Another Gasoline Substitute from South Africa

The fifth gasoline substitute to be advertised from South Africa as a means of lowering the cost of automobiling has just been reported to the Department of Commerce, by Trade Commissioner P. J. Stevenson, Johannesburg. It is, like most of its predecessors, an alcohol fuel produced as a by-product from sugar cane. A company has been formed to exploit it. It is reported that 3,000 gallons are being manufactured daily. More power and mileage and easier starting qualities are claimed for it, apparently in comparison with gasoline. It is claimed that it will start quickly in cold weather, also that it can be used as a heating spirit. The price it is said, will not exceed two shillings threepence in Johannesburg. A demonstration trip is now being made around South Africa by one of the directors.

In connection with the agitation for cheaper motor fuel, which is being led by a Johannesburg newspaper, it is of interest to note, says Mr. Stevenson, that the Union government has appointed a committee to inquire into the economic possibilities of the production of oil in South Africa from vegetable matter, coal, shale, and other substances. The oil fuel committee, as it is called, has asked publicly for evidence of information pertinent to their inquiry.

It is said that in furtherance of this movement the government will be asked to enact legislation providing that imported gasoline shall not be sold at a lower price than the pre-war figure, 14 shillings 9 pence per case, plus 25 percent, to preclude any possibility of foreign gasoline companies killing off a new liquid fuel industry by selling gasoline at ridiculous prices. The "anti-dumping" amendment to the customs act passed at the last session of parliament would seem, however, to be an effective precaution against such a possibility.

Automobile Roads in Italy

An important step which should lead to general road improvement in Italy has been taken in Milan. A company has been formed to build an automotive highway between Milan and the northern Italian lakes, Como, Varese, and Maggiore. Use of the road will be restricted to motorists. The movement is backed by the Milan Touring Club and a group of important Milan business men. The distance to be covered by the road is only 86 kilometers, but it will connect some of the most famous tourist resorts of Europe. The cost is estimated at 60,000,000 lire, of which 25,000,000 lire will be raised by the sale of the stock and the rest by debentures guaranteed by the state and by the capitalization of subsidies. The maintenance of the road will probably be financed by tolls. The general government, it is said, has already promised an annual subsidy of 1,500,000 lire. The work will be begun soon and it is hoped that it will be completed by the end of the year. It will probably be made of asphalt. The width will be ten meters for the first ten kilometers out of Milan and eight meters the rest of the way.

The Milan Automobile Club, in "boosting" the project, states that only one Italian in Italy in a thousand possesses a motor car, compared with eight to the thousand in France, and 15 in England, and argues that the good roads movement will help to redeem Italy's reputation by increasing the number of passenger cars in the country.

French Auto Industry Recovering

The French automotive industry is recovering rapidly, says Assistant Trade Commissioner Singer, Paris, in a report to the automotive division of the Department of Commerce. French automotive manufacturers, according to Mr. Singer, attached great importance to the success of the seventeenth international automobile salon, held recently in Paris.

Prices of French motor vehicles are about the same as last year except for the increase due to the wider use of four-wheel brakes. Several firms turned out new models, generally low powered, such as the new 6-horsepower Renault, 10-horsepower Voison, 11-horsepower Belege, 12 horsepower Delaunay-Belleville. The new French Omega-6 was apparently very favorably received by the public. It is equipped with a 11-horsepower motor, 6 cylinders in line, overhead valves, bore 65 millimeters, stroke 100 millimeters, motor speed 2,800 revolutions per minute, magneto ignition, three speeds forward, brakes on all four wheels, electric starting and lighting systems. The Omega-6 consumes approximately 11 liters of gasoline per 100 kilometers, and is manufactured by Cadoux & Daubeck, engineers, main office Paris, capitalized at 24,000,000 francs.

There were approximately 48 passenger cars and truck manufacturers in France in 1913. It is estimated today there are 75 with a capacity of approximately 100,000 cars and trucks per annum and that production is between 50 and 70 percent of capacity.

The Citroen factory is said to produce 32 percent of this number, Renault 16 percent, Peugeot 14 percent, de Dion-Bouton 6 percent, Panhard-Levassor 6 percent, Chenard-Walcker 4 percent and other manufacturers 26 percent.

Hardwood Institute Annual, May 10-11, at Chicago

The Hardwood Manufacturers' Institute will hold its first annual convention on May 10 and 11 at the Blackstone Hotel, Chicago. The program will provide a fitting celebration of the tremendous strides the institute has made since its organization in June, 1922. From some 70 members, at its inception, the institute now has over three hundred bona fide hardwood producers and represents upwards of a third of the hardwood lumber manufactured in this country. The first institute lumber inspection force of three men is now increased to an inspection corps of 12.

Prominent speakers will address the convention, representing outstanding hardwood consuming interests, figures of national prominence in politics, government and general business, authorities on general and technical phases of the lumber industry.

Every hardwood manufacturer is invited to attend this meeting whether a member of the institute or not.

47% of Michigan Cars in Rural Districts

Forty-seven percent of Michigan's motor vehicles are registered in the 74 rural counties. The latest census report, of three years ago, indicated that about one-third of the automobiles were farmer owned, but subsequent state reports tend to show that the proportion is increasing.

Building An Accessory Business

(Continued from Page 17)

all over his clothes, lost his temper and 15 minutes on the job of measuring. Yet he could only charge a little for the hose; no one wanted to pay for all the time and discomfort. That is why the dealers left most of this business to the service branches of the manufacturers. And they were losing profitable business.

This Led to a "Bright Idea" That Worked

Profiting by our experience with the fan belts, we tabulated all the different specifications for radiator hose. There was a great variation in lengths, though not very much variety in the diameters of hose used. So again we made up a chart showing just what each model of each make of car requires.

Someone got a bright idea, and as a result we devised a plan by which we print inches and half-inches right on the hose just as a ruler shows them. Now when the customer comes in for a radiator hose for a 1920 Packard twin-six, the dealer looks at his chart, takes his knife and cuts off 8 in. of 1½-inch hose. He doesn't even need a rule, because the measurement is already marked on the hose. We have made his work easier by making each piece of hose carry its own yardstick.

The result of that simple convenience—the natural outcome of putting ourselves in the place where we could look through the customer's eye—is that our line of radiator hose is in almost every dealer's store in the land. The demand for it, just as with our fan belts has worked back to the makers. And already, though the line is only a few months old, we have several prominent makers who are using our hose on all their cars.

And we have found that this same habit of thought, adapted to the needs of the situation, is just as mutually advantageous in dealing with employees as it is in outside relations. As our business grew, more particularly at the time when most concerns were having much trouble with their workers, we began looking into the situation with the workers' point of view in mind. "What," we asked ourselves, "is it that workers really want, that causes all this loss of time through strikes, and the loss of production through slacking which in the long run comes out of the workers' own purses?"

The philosophy back of it, it seemed to us, is what has been said a good many times before: with the evolution of the factory system, and the specialization which inevitably results in less interesting tasks, the worker loses interest in the job. Not many years ago, a workman gave of the best there was in him so that he might earn for himself the reputation of "The best blacksmith at Johnson's," or the best carpenter, or cabinet-maker, or as the best at one of the comparatively few trades which were then recognizable in any business.

Everybody knew what those trades were, and a whole town might know of Bill Smith's prowess at the forge. But it is inconceivable to me that any man of ordinary caliber is going to work along for all he is worth, and perhaps sit up at night devising short-cuts in his work so that he is "The best bevel cutter on inner tubes in the vulcanizing department at Gates Rubber."

Like the man who had driven "the fastest mile ever driven behind a black four-year old gelding pacer, with two white stockings and a roached mane," it may be a worthwhile accomplishment but it doesn't mean very much to most people. The highly specialized job of the average skilled factory worker gets him nothing in the way of reputation for ability outside his immediate department.

A "Workable" Plan to Help the Workers Along

Today the only common denominator of recognition which remains for the factory worker outside his limited circle at the plant is his income, the money he brings home Saturday night. If he lives on a good scale, then the neighbors reason that he must be a good man to draw the necessary money.

Working on that idea, we set about to devise some plan that would enable us to offer our workmen better pay than might ordinarily be expected to go with their jobs. On the way we found it advisable to set up an "industrial democracy" plan, which with us has functioned admirably. In fact, it is the mechanism through which we have been able to attain results desirable both for the company and for the employees.

Each department of our plant has a committee of workers, which in conference with a central committee of the industrial congress sets what is known as the "competitive base rate" for the operation performed in that department. There is no effort made to get a base rate on each operation on each machine in the department. If it is a question of a department where tires are vulcanized, the rate is set for the whole process of vulcanizing.

When the costs of the industry for any operation show a tendency to fall below ours, the rate setting committee—mind you, it is made up of the workers themselves and is without management representation—cuts the "competitive base rate" to at least the level of the rest of the industry. Thus the matter is adjusted almost automatically.

There is no question of cutting wages. We are still paying the same wages we were paying when the plan was inaugurated, at almost the height of the period of high prices. But we can do so because our costs are far below those of the average of the industry. Obviously, we could not continue to pay such wages under any other conditions.

When the competitive base rate is set by the committee and approved by the management, that is the accepted rate of cost for the operation in that department at the prevailing wage scale. If the actual costs are pulled down below this base rate, the savings are shared 50-50 by the company and the employees in the department. In not one of our manufacturing departments has the monthly production dividend, as this money is called, amounted to less than 8 percent on the wages of each employee in the department, the highest figure in any department for the year was 43 percent added to the wages of the workers there; and the average, throughout the year and throughout the plant, was 21 percent.

How the Office Departments Get Their Dividends

We have not found it practical to figure quite the same way for the office departments. So all of our office employees, except executives, are paid quarterly a dividend of exactly the same percentage of their total salaries as the rate at which the company has earned profits on its sales during that quarter.

Executives share in the profits by still another plan.

Our workers, all the way through the business, really work. Walk through our plant, for instance; watch the attentive, determined way in which every man is bending to his task; and you will exclaim as more than one man has exclaimed to me as I showed him through: "I thought we had a good working spirit in our plant. But, man alive,

I never even dreamed the employees worked like this anywhere on earth! What's the magic?"

It all goes back, you see, to our looking at the question of industrial relations through our own employees' eyes. We saw that the worker wants recognition by earning power. We gave him the chance to earn more money than is earned by any other men of similar skill anywhere; but to do so, he and his associates must cut our costs below that of the average in our industry. And, mind you, that is just exactly what these employees have accomplished.

Of course we have never had any labor trouble. I don't see how we could have, with this situation prevailing.

Our workers trust the figures by which their production dividends are computed, because the office employes, including the folks who work out all the figures on the books of the company, are all paid according to the same general plan. The bookkeepers want to show low costs and big profits and the men out in the plant know that.

Office workers, because as a class they have a closer contact with the affairs of management, can be counted on to look ahead three months toward the company's net profits. So, even though we were to find a satisfactory method of computing office production standards, I doubt whether we should be inclined to adopt it and pay production dividends accordingly. Our office employees work just as hard at their work, as do the factory people at theirs. They keep their eyes open for methods to cut costs, and for sales possibilities as well.

What does this all prove, this description of the way in which we go about looking through other people's eyes, standing in other people's shoes, as a commercial method of making money? The answer, I think, is straightforward, simple, and narrative.

Our whole enterprise started only 10 years ago, with $3,500 of working capital and a business which was losing money at the time. No outside capital has ever come in. In 1922 we did a volume close to $6,000,000. We are growing at a rate which keeps the line on the chart pointed steadily toward the northeast corner of the paper. Our wage and salary scales are the highest in our industry. Our costs are the lowest, or pretty close to it. The two, as I have already stated, go pretty much hand-in-hand.

These results are not cited boastfully, but simply to indicate to other business men that these are not theories which fail to produce tangible results. The results are real, and may be measured in terms of dollars as well as terms of satisfaction.

For what we have accomplished we have done through holding steadfastly to the other fellow's viewpoint.

Duty Helps Cheap Cars in India

Indian importers of English and continental cars are complaining that the 30 percent import duty is taking their trade away and turning it to low-priced American cars and they are agitating for a revision of the tariff. "The other day I handled a car," says one of these dealers, "which cost 7,000 rupees in duty alone, and it is easy to see what that sort of thing will do to the high priced car market." From April 1, 1922, when the duty went into force, to Sept. 30, 835 American motor cars have been imported, compared with 262 in the same period of 1921, an increase of almost 200 percent. During the same period importations of Canadian cars increased from 173 to 624, or over 260 percent.

Buick's Millionth Car

The Buick Motor Co., excepting the Ford, is the first concern to reach an accumulated total production of a million cars. That the total has been achieved with a diversified line makes the accomplishment even more remarkable. The millionth Buick engine was announced about the middle of February. The car bearing that serial number consequently will soon be turned out.

More than half of the total production of the Buick Motor Co. has been sold in the last five of the nearly 20 years since the line was founded. Accepting the preliminary estimate of 134,000 as the approximate output for 1922, the aggregate production for the five years, 1918 to 1922 inclusive, was 528,810, as follows:

1918	74,856
1919	119,853
1920	116,213
1921	83,888
1922	134,000
Total	528,810

The first Buicks, 16 of them, were built in 1903 as a side issue of the old Flint Wagon Works. The first five years' activity of the present concern resulted in the production of about 6,400 cars. Today, with a personnel of 18,000, it is producing upwards of 16,000 cars a month from its American plants alone, or at an indicated capacity of 190,000 cars a year.

Ford Pays Lincoln Creditors in Full

Henry Ford has paid the balance of claims of all creditors of the Lincoln Motor Car Co. The payment of the remaining 52 percent of claims involved a disbursement of something like $4,000,000. Ford announced at the time he purchased the concern at receiver's sale that it was his intention to do so. Ford purchased the Lincoln business for $8,000,000 in February, 1922.

After paying preferred claims from the sale to Ford for $8,000,000, the receiver had upwards of $5,000,000 for settlement of the government claim arising out of the concern's contract to build Liberty engines during the war. This, originally assessed at more than $9,000,000, was finally compromised for a million and a half, or thereabouts.

After having settled this claim there remained about $3,600,000 to pay approximately $7,500,000 worth of ordinary creditors' claims, and it was this final settlement, at the rate of 47½ percent on the dollar, that was generally thought to have concluded the performance, as far as the creditors were concerned. This settlement transpired just about a year from the date of Ford's purchase of the company. Creditors affected are said to number about 900.

Seven former directors of the Lincoln, who had endorsed paper held by the banks, were also reimbursed. The final payment, added to the original purchase price, and including payment to Henry M. Leland and his son of something over a million dollars, brings the total cost of the concern to Ford up to about $13,000,000.

Fifth Avenue Traffic

Between 7 a. m. and 7 p. m. on a day recently selected for a test by the New York police department, 21,872 vehicles passed the traffic tower at 42nd street and Fifth avenue. There were 9,963 northbound vehicles and 11,909 southbound.

Tut's Vehicle Strictly Up-to-Date

The sensational find of a number of richly ornamented, gold tired chariot wheels in the tomb of King Tut-Ankh-Amen at Luxor, Egypt, has sharply revived scientific interest in the origin and development of wheels of modern type.

Expert scrutiny reveals remarkably up-to-date design and construction in the wheels that carried Egypt's pharaohs in battle and procession 3,500 years ago.

The hub, spoke and rim construction of the wheels used by King Tut-Ankh-Amen show surprising grace of outline, combined with extraordinary strength. Built for the violent exigencies of warfare, they had to be extremely light, for speed, as well as tremendously strong, to withstand the shock of collision and maneuvering over rough terrain.

Notable also is the excessive length of the hubs and their narrow diameter, perhaps calculated to reduce friction and to enable the holding of proper alignment.

In the bronze used for spindles and bearings the Egyptians possessed a bearing metal that modern metallurgy has never been able to duplicate. The unique process that gave this metal its marvelous hardness and wearing quality ranks with the lost arts, perhaps never to be rediscovered.

Equally as amazing as the structural soundness of the wheels unearthed at Luxor is the richness of their ornamentation. Imagine the wealth of a dynasty that enabled the use of solid gold for tires.

Even so, King Tut-Ankh-Amen would probably have found a journey in a modern motor car much more to his liking. Springs were unknown in those days, as were pneumatic tires, disc wheels, shock absorbers and other accessories in common use by millions of Americans today.

For cushioning rough roads, sole reliance was placed upon tightly drawn skins that composed the chariot floor. This may have been satisfactory for the limited distances that a chariot had to cover, but what a wail it would bring from the owner of a modern motor car.

With all the pride we take in our own civilization, however, and its marvelous accomplishments, transcendant recognition seems due the ancient Egyptians for the high state to which they advanced the mechanical arts, thousands of years in advance of our time.

Had this development proceeded uninterruptedly, instead of being swept away and buried by famine, war, and pestilence, our present scientific attainments would probably have reached heights today that even our current sensational rate of progress will not have achieved centuries hence.

Highest Mark in Its History

Net sales of the General Motors Corp. for the year ended Dec. 31, 1922, were $463,706,733, the high mark in its history. After all charges, the surplus available for dividends was $51,496,136, and after regular dividends on preferred and debenture stocks, requiring $6,429,228 there remained $45,066,908, or $2.19 per share on 20,557,750 shares of no par value common stock outstanding. This shows against a deficit before dividends of $38,680,770 in the year previous. There was carried to surplus account $34,889,791, after deducting a common dividend of 50c, against a final deficit in 1921 of $65,459,057.

Team Work Essential to Successful Manufacturing Organization

L. V. Cram, production engineer with the Chevrolet Motor Co., read a paper at the meeting of the Detroit section of the S. A. E., Feb. 2, in which he stressed the value of a more intimate contact between the engineering and manufacturing departments. He argued that engineering service must not be considered complete when it provides satisfactory drawings, bill-of-material and an efficient alteration system. There is a fourth requisite equally important, the presence of an engineer of judgment in the shop all the time, keeping pace with production development, making decisions, giving courteous advice and seeing that proper record is made of all improvements in method or product that originate in the shop. No producing organization stands still for a minute; ideas are germinating all the time in the interest of progress and many of these are worthy of adoption. It is the function of the engineering department to seek these out, pass judgment on them and effect their application. This necessitates the engineer's presence in the shop. It is a mistake to take a mechanic from his machine into a private office in the hope of securing his ideas; the change in environment makes him self-conscious and, usually, silent. Cultivate the spirit of cooperation in the shop, encourage the submission of suggested improvements, and the constantly improving product will reflect credit on the engineer eventually.

George E. Goddard read a paper prepared by H. W. Hayes in which the method of effecting alterations in the Dodge Bros. factory was explained. It was of particular interest to learn that a small number of altered parts or units were run through the complete manufacturing and assembly routine before an alteration was made effective definitely. This procedure assures the clearing up of many unanticipated interferences and objections before the alteration takes final form, thus eliminating disagreeable production tie-ups when the change becomes effective.

Walter Fishleigh, of the Ford Motor Co., gave a forceful talk on the philosophy of cooperation. He stated that the factories which seem to accomplish the greatest success are often those with the most meager and undeveloped system and organization. It was his belief that most executives underestimate the importance of morale and teamwork in the proper functioning of an organization. System and organization rules were likened to the signals of a football team; they are an important accessory, but without team-play are ineffective. Mr. Fishleigh is of the opinion that all engineers are production men in this sense. Engineering "departments," considered as units set apart and separated from the shop by frosted glass partitions, should not exist. Engineers must come from behind these partitions, interest themselves in the shop and get acquainted with its men. This is fundamental to teamwork and true organization. Too many partitions are directly responsible for the feeling in some production departments that cars must be built "in spite of the engineers."

The words "change" and "alteration" should be discouraged; substitute in their stead the term "improvement." Mr. Fishleigh remarked that any change which is not an improvement lacks justification. No successful product endures without constant improvement and this of necessity means constant alterations.

Air Cooling Progressing Rapidly

(Continued from Page 10)

the top is left unfinished. The connecting rods, light and strong, are made of alloy steel, drop forged and carefully machined and balanced.

This covers all the present crop of air-cooled engines and cars, except the Chevrolet. This was described at some length in recent issues, so the description will not be repeated. Other interesting details incidental to air-cooled engines may be covered in a later article.

Eastern Body Plants Reduce Freight Charges

With the increasing popularity of enclosed bodies for automobiles there has come a demand on the part of the motoring public for lower prices for well made jobs of the custom built type. The cheaply made body of the sedan or other closed type, it is found, does not last even half the life of the chassis. Hence the growing demand for better built jobs at more reasonable prices.

That the solution of this problem for eastern motorists is to be brought about through the operation of large body factories located in the east, is the assertion of Arthur H. Wolfe of Newark, who is vice president of the Springfield Body Corp. In an interview recently Mr. Wolfe discussed this subject as follows: "One of the principal advantages of locating plants for building high grade automobile bodies in the east, is the economies effected in freight charges. The large box cars used by the railroads for shipping automobiles will carry but three complete cars, and from the middle west to factory points the freight charge will average at least $45 per car. The same railroad box car will carry 12 chassis, crated, with road wheels, fenders, and steering post removed, at a cost of about $12 per chassis. This $33 saving in freight charges becomes an important item when multiplied by a large number of cars. For example our two plants at Springfield, Mass., and at Bloomfield, N. J., have a yearly capacity of some 20,000 bodies. Their location in the east means a saving on freight charges alone of $660,000, which is of equal benefit to the chassis maker and the motorist. The same economy is effective in the case of cars exported from North Atlantic ports. In addition, there is another saving in that we can box complete cars at the Bloomfield plant and deliver by motor truck right to the steamship in the port of New York.

"As a member representing New Jersey on the New York terminal committee, appointed by the Interstate Commerce Commission in 1920, I have had occasion to make a careful study of transportation costs, especially in relation to the selling prices of commodities. This is the reason for the location of our various plants, not alone the two in the east but those we are arranging for at several points in the west."

Luxury Tax on Imported Cars Favor Cheaper Make in India

During the first eight months of 1922 India imported almost twice as many motor cars as in the corresponding period for the year previous. The total value of cars imported were less, however, for the last eight months ending November, 1922, when 2,919 cars were imported valued at 97 lakhs than for the eight months' period of 1921, when 1,503 cars were imported valued at 105 lakhs.

Canada's importation of cars increased from 233 cars valued at 6 lakhs to 1,053 cars valued at 19¾ lakhs, and America's from 441 cars valued at 23 lakhs to 1,234 cars valued at 39½ lakhs; while imports from the United Kingdom shrank from 431 cars valued at 50½ lakhs in the period April-November, 1921, to 256 cars valued at 20½ lakhs in the period of April-November, 1922.

The complaint is made by British manufacturers that the 30 percent luxury tax on importation of motor cars favors the makers of the low priced cars in the United States and Canada, as against the higher priced car of British manufacture.

More American Cars at Brussels Show

The 16th Salon de l'Automobile et du Cycle held at the Cinquantenaire, Brussels, Jan. 13-24, 1923, was marked by a larger representation of American cars than the show of 1921, though the exhibits of motorcycles, trucks, and tractors of American origin were somewhat smaller than might have been expected. Only one American motorcycle manufacturer was represented, while three American trucks and two American tractors were exhibited. High-priced American cars were more in evidence this year; three such makes being exhibited, one of them by a Dutch agent. Sales on the whole are reported to have considerably exceeded those of last year, though agents of American makes who had been financing themselves by acceptances were in one or two cases somewhat disconcerted by the current exchange movement. The impression created by the American stock bodies, especially of sedan type, was generally more favorable than previously, even in the presence of high class custom-made carriage work of Belgian origin. Only one British car was exhibited.

Belgian automobile makers are very generally producing models with four-wheel brakes, the Metallurgique using the Excelsior-Adex type and the Minerva a modified Perrot. Several hitherto unknown Belgian makers appeared at the show with experimental exhibits, among them the Dunamis, Laisne, Aureau, and Jewel, the last-named being especially advertised as a series-made product. The show was also marked by the disappearance of the Belga and the reappearance of the Sava (Antwerp), which did not exhibit last year. No German or Austrian makes were admitted, though Mercedes, Benz, Austro-Daimler, and Steier have made extensive sales during the past year in Belgium; Austro-Daimler is now taking orders for a new model with a turbine motor regarded as a marked advance in technique.

Canadian Automotive Exports Decrease

Total exports of automotive products from Canada during January, valued at $2,896,486, showed a decrease of 19 percent, as compared with exports during December, 1922, valued at $3,550,680. Passenger car exports during January numbered 4,666 valued at $2,530,005, as against 5,475 in December valued at $3,256,230, and 1,344 a year ago valued at $904,667. Shipments of motor trucks totaled 369 valued at $141,621, as compared with 216 valued at $73,230 during December, 1922. Exports of parts valued at $225,220 showed a slight increase over December exports valued at $221,403. The largest markets for passenger cars during January, 1923, were Australia with 18,000; United Kingdom, 1,564; British India, 257; New Zealand, 236; and South Africa, 143. Australia took 277 trucks, while British India took 30.

Big Increase in Motor Vehicles in 1922

In 1922 motor vehicle registrations more than maintained the rate of rapid increase which has caused the total registration to grow from 3,500,000 in 1916 to 12,238,375 motor cars and trucks at the end of 1922, according to the Bureau of Public Roads of the United States Department of Agriculture. Last year the increase amounted to 1,775,080 registrations as compared with an average yearly rate of approximately 1,390,000 for the preceding five years.

The table issued by the bureau gives registrations by states which total as follows for the whole United States:

Private passenger cars	10,890,112
Taxicabs, busses, and cars for hire	69,459
Motor trucks and commercial cars	1,278,804
Trailers	29,328
Motorcycles	182,714

A comparison of the truck registration figures with those for the preceding year shows an increase of 30 percent indicating that this phase of highway transport is undergoing rapid development. The increase in truck registration is not confined to industrial sections. Such agricultural states as Virginia, Indiana, and Florida show increases of 33 percent, 30 percent and 29 percent respectively which seems to indicate that many farmers are changing their method of hauling as a result of road improvement.

The total gross registration revenue amounted to $152,047,823 of which $117,093,116 was applied to road work under the supervision of the state highway departments. Eighteen states taxed gasoline, deriving a revenue of $11,923,442, not all of the states reporting for a full 12-month period. Of this amount $6,474,178 was spent under the supervision of the state highway departments.

Use Motor Transport for Economy

American Short Line Railroad Association has found that many lines operate motor cars at a cost of from 10 to 25 cents a mile, including all charges, as compared with a cost of from 65 cents to $1 to the train mile in the operation of steam trains. The extremely low cost of 19 cents a mile covers the operation of smaller cars seating 20 to 25 passengers and served by one man. Larger cars, seating 45 to 55 passengers and carrying baggage, are operated by two men, and the average cost, including all charges, is 25 cents a mile.

Ford Lets Contract for Glass Plant

Contracts have been let by the Ford Motor Co. for what is described as the largest glass plant in the world under one roof. Dimensions will be 350 x 1,000 ft. and this factory when completed will supply the latest methods for manufacture of glass. These methods are the result of Ford's experimental work which it is stated, have run into a sum close to $5,000,000. The plant will be located on the west side of the River Rouge, with only the narrow river separating it from the Rouge factory.

Though the Netherlands are an old and intensively developed country, close to the sources of motor cars, and New Zealand is a new and pioneer island way off on the edge of the world, the latter has 35,000 motor cars, and the Netherlands have but 20,000. Perhaps the Dutch canals are the explanation.

German Auto Industry Fears Rising Prices

Depression of the mark, rising prices of raw materials, and other high production costs, and the necessity of protecting the German automotive industry from danger of foreign capital control, caused widespread capital increase during 1922. The building up of inland and foreign sales organizations along with concentrations and other associations also required new outlays.

Business in the motorcycle industry, however, does not appear to have changed greatly; great activity was reported from some quarters, one special firm reporting that its output for the next five years has been sold to the Federal Association of Motorcycle Dealers. The growing popularity of the motorcycle in Germany is attributed in part to the increase of fares on public conveyances, which makes ownership of motorcycles by large classes economical.

Further prosperity of the German automotive industry depends almost entirely on foreign orders, and the outlook is said to be favorable on account of the growing popularity of German cars in foreign markets. In the Stuttgart District alone, seven large automotive firms have an annual production of approximately 8,300 passenger cars and 600 trucks. About 74 percent of this production is sold in Germany, and 26 percent exported, chiefly to Italy, Spain, Switzerland, Balkan States, Netherlands, North and South America, and the Far East.

Notwithstanding the fact that in general the industry faces the new year well supplied with orders, constant fear exists that increasing German prices will eventually exceed world market figures.

Body Makers to Help in Study of Timber Supply

Automobile body manufacturers and the National Hardwood Lumber Association will organize a joint committee to cooperate with the United States Forests Products Laboratory and defray all expenses necessary to conduct a scientific study of sap stain in gum and interior dote in elm lumber, with a view of improving stock suitable for the construction of automobile bodies.

Efforts will be made to make possible the use of a greater portion of the log in industry, to stimulate the movement of the more common grades into regular trade channels and to eliminate certain so-called defects, many of which result from custom and trade practices rather than inferiority in growth and manufacture.

It is possible that changes will be made in the standard rules for the measurement and inspection of hardwood lumber. Recommendations toward this end will be submitted at the annual meeting of the lumber association in June.

Liberia the Least Motorized Country

Liberia, on the west coast of Africa, has the least number of automobiles of all countries in the world, according to the world census of automotive vehicles by the automotive division of the Department of Commerce. Latest available statistics from that country gives the number of cars as 17. The next country to Liberia at the bottom of the list is British Honduas with 61 passenger cars, 12 trucks, and 2 motorcycles. Liberia has no trucks or cycles.

MEN OF THE AUTOMOTIVE INDUSTRY

Who They Are What They Are What They Are Doing

R. P. Henderson has been made general sales manager of the Martin-Parry Corp. He was formerly vice president in charge of sales, a position he was appointed to, following the consolidation of the Martin Buggy Co. and the Parry Mfg. Co. in 1918. Henderson was one of the organizers of the Cole Motor Car Co. and later was builder of the Henderson car. In 1916 he became associated with the Parry company at Indianapolis as general sales manager. While with that concern he helped develop the buggy business into one of building bodies for commercial purposes.

George A. Vis, who has had charge of all non-productive material at the Maxwell Motor Co., has been made general superintendent of the Automotive Gear Works, Inc., of Richmond, Ind. Before going with Maxwell he was assistant general superintendent of the Lincoln Motor Co., during the time that company was producing Liberty motors and after the plant was rearranged for passenger car production.

E. G. Gunn, former chief engineer of the Packard Motor Car Co., and more recently serving as an engineering consultant in Detroit, has become chief engineer of the LaFayette Motors Co. Gunn has long been associated with the industry, having been a designing engineer with the Northway Motor & Mfg. Co., back in 1916, and thereafter holding a number of important posts.

Henry A. Klein, who designed and prepared for production the latest model for the Durant Motor Co., has resigned, effective Feb. 19, to become associated with the Eadie Trailer Corp., 191 Ninth avenue, New York. He will take charge of standardization of design and production of patented devices for trailers and other four-wheeled reversible tracking vehicles.

J. G. Robertson, treasurer of the Firestone Tire & Rubber Co., and identified with its interests for 12 years, has resigned. At the time of his withdrawal he was serving as supervisor over subsidiary interests of the company. No indication of his future activities has been made public.

J. T. Trumble has been appointed experimental engineer of the Olds Motor Works, Lansing, Mich. He has been identified with the automobile industry for several years and was recently with the Samson tractor division of the General Motors Corporation.

J. H. Johnston has been appointed controller of the Rickenbacker Motor Co., Detroit. He has served in the capacity of executive head of the production cost department since the Rickenbacker company began operations.

Walter S. Kidd has been appointed vice president and general manager of the Wilmington Automobile Co., Wilmington, Del., Oldsmobile merchants. Kidd was formerly plant engineer of the Olds Motor Works.

H. C. Dunning, former assistant general manager, Olds Motor Works, has been made vice president in charge of production of that company. Dunning has been identified with the Oldsmobile interests since 1921.

Harry Griffith, general manager of the Midwest Engine Co., Indianapolis, Ind., is returning to Detroit, April 1, to become assistant to Walter Briggs of the Briggs Mfg. Co.

J. Linde Hopkins, of the Hendee Mfg. Co., Springfield, Mass., has been elected to the directorate of the Wire Wheel Corp. of America to succeed Jacob Bretz, resigned.

Fred H. Diehl, purchasing agent for the Ford Motor Co. is back at his desk after an extended trip abroad in the interests of the company.

Alfred G. Way has been elected treasurer of the Fafnir Bearing Co., manufacturer of bearings and hangers, New Britain, Conn.

News of the Body Builders

America's Best Trailer Truck Co., Inc., Memphis, Tenn., recently organized with a capital of $1,000,000, has purchased a local building and will remodel the structure for the manufacture of trailer trucks for factory and other service. **Joseph Newberger** is president and **T. M. White** general manager.

Fisher Body Corp., Detroit, has called for bids for the erection to its new plant at Pontiac, Mich., with main structure two stories, 150 x 500 ft., estimated to cost $2,000,000 with machinery. Fred J. Fisher is head.

Shunk Mfg. Co., Bucyrus, O., will engage in the manufacture of motor truck hoists and truck bodies. It will occupy the Allen Motor plant, in which some new equipment will be installed.

Perfection Trailer & Mfg. Co., Cleveland, has had plans prepared for a factory to cost $75,000.

Edward R. Parry

Edward R. Parry, one of the pioneer automobile body manufacturers of the country, died at the age of 72 at his home in Indianapolis on Washington's birthday. He was one of the organizers and vice president of the Parry Manufacturing Co., until his retirement four years ago when the institution became the Martin-Parry Corp. He was born March 16, 1850, near Pittsburgh, and early in life moved to California. Twenty-seven years ago he went to Indianapolis where he and two brothers organized the Parry company. Before becoming identified with the automotive industry the company was widely known through the central states for its buggies and light vehicles. A widow and one daughter survive.

Henry Phineas Jones

Henry Phineas Jones, pioneer wheel maker, died Saturday, March 17, at East Orange, N. J., at the age of 76. He was for 57 years identified with Phineas Jones & Co., Newark, manufacturers of wheels, of which organization he was president. His father, the late Phileas Jones, founded the wheel making company and came of Revolutionary stock.

W. Oscar Shadbolt

W. Oscar Shadbolt, head of the Shadbolt Mfg. Co., manufacturer of trucks, commercial bodies and trailers, died March 11 at his home in Brooklyn, N. Y. He was 70 years old, and had long taken an interest in the affairs of the local trade among whom he was widely known.

There is high authority for the statement that of all the hotel and office skyscrapers in the United States, 85 percent have been contracted for in periods of depression.

ACTIVITIES OF AUTOMOTIVE MANUFACTURERS

Where They Are Located What They Are Doing How They Are Prospering

Automotive Utilities Corp. of Michigan, a new company organized for the purpose of manufacturing special wheel and axle equipment for Fordson tractors and automobile trucks, has been merged with the Automotive Utilities Corporation of America. Officers of the company are: T. T. Hollinger, president; A. R. Thomas, vice president, treasurer and general manager; R. T. Yeats, secretary: E. W. Soleau, assistant secretary-treasurer.

Revere Motors Co., Logansport, Ind., recently organized with a capital of $250,000 to take over the local plant of the Revere Motor Car Co., in receivership, has taken title to the property, and plans early operation for the manufacture of automobiles and parts. Improvements will be made in the machinery, including replacements. The new company is headed by Charles E. Barnes, Jesse M. Johnson and Adolph Monsen.

Timken Roller Bearing Co. is making provisions for a considerable increase in the production of Timken tapered roller bearings at both the Canton and Columbus plants. Additions to equipment are being received at both factories and production capacity is being materially increased almost daily. At the Canton plant, a large factory building is in process of construction, on which work is being rushed to completion.

Haynes Automobile Co., Kokomo, Ind., officials have organized a subsidiary company to be known as the North Texas Haynes Co., to establish and operate a factory branch at Dallas, Tex. A three-story building has been leased at Young and Browder streets and equipment will be installed at once. A parts department and machine shop will be installed. David McCosker will be in charge.

Chevrolet Motor Co., Detroit, has awarded contract for a four-story factory branch, 100 x 150 ft., at Commerce street and College avenue, Dallas, to cost $125,000. A complete parts department and machine works will be installed. The property will be owned by a local investment company and occupied by the Chevrolet company under long lease.

Inland Mfg. Co., Dayton, O., a Delaware corporation, has been organized as a subsidiary unit of the General Motors Corp., to manufacture automobile steering wheels and other accessories. It has taken over plant No. 3 of the Dayton-Wright Co. and it is understood that extensions are contemplated. H. E. Talbott, jr., is president.

C. G. Spring Co., Kalamazoo, Mich., has moved its general office to Detroit in addition to having established a manufacturing and plating plant there recently. Christian Girl, president of the company, has announced that there is no intention of moving the main plant to Detroit at present.

Franklin Motor Car Co., manufacturer of automobiles with main works at Syracuse, N. Y., has purchased the former plant of the Browning Gun Co., College Point, L. I., to be used by a subsidiary organization for the production of automotive products.

Doble Steam Cars Co., San Francisco, manufacturer of steam-propelled automobiles, will commence the erection of the first unit of a new plant at Emeryville, Cal., where an entire block has been purchased. It will cost about $100,000, including machinery.

Ford Motor Co. will build a hydroelectric generating plant at the high dam, Mississippi river, between St. Paul and Minneapolis, Minn., estimated to cost about $2,000,000. It will be used in connection with a new assembling plant to be erected in this district.

Auto Car Co., Ardmore, Pa., manufacturer of motor trucks, will install a machine shop and parts department in the new one-story service works, 65 x 215 ft., being erected on Whalley avenue, New Haven, Conn., estimated to cost $50,000.

Detroit Steam Motor Corp. of Canada, 493 Yonge street, Toronto, with a capital stock of $1,000,000, is completing arrangements for the establishing of a manufacturing plant. Arthur B. Muir is in charge of the Toronto office.

Larrabee-Deyo Motor Truck Corp., Binghamton, N. Y., has acquired a site at Main and Emma streets and plans the erection of new works, to cost close to $200,000 with machinery. Frank T. Macey is vice president.

Washington Motor Co., Eaton, O., manufacturer of the Washington motor cars, will move its plant to Middletown, O., and is contemplating the erection of a building, 80 x 200 ft. A. H. Christman is president.

Paige-Detroit Motor Car Co., Detroit, has plans under way for an addition to its plant on West Warren avenue, estimated to cost $1,000,000 with machinery. It is expected to commence work late in July.

United States Axle Co., Pottstown, Pa., manufacturer of automobile axles and automotive parts, is planning for extensions and additional machinery. A fund of $200,000 is being arranged for the expansion.

Reo Motor Car Co., Lansing, Mich., has leased a three-story building at 2113-17 Main street, Dallas, Tex., for a factory branch. A parts, service and general machine department will be installed.

Stearns Co., Cleveland, will enlarge its automobile plant by the erection of a two-story building, 220 x 300 ft., at an estimated cost of $600,000, including machinery equipment and enameling ovens.

Davis Motor Car Co., Richmond, Ind., is contemplating doubling production at its automobile plant. George W Davis is president, and Walter C. Davis, secretary and general manager.

Bridgeport (Conn.) Motor Truck Co. has acquired the former plant of the Liberty Mfg. Co., Longbrook avenue, Stratford, Conn., for $50,000 and will establish a new works.

Ford Motor Co., Highland Park, Mich., will commence the construction of a four-story generator plant at its local works, to cost $50,000 exclusive of equipment.

New Process Gear Co., Plum street, Syracuse, N. Y., a subsidiary of the Durant Motors, Inc., will commence the erection of a one-story addition to cost $40,000.

Ford Motor Co. plant at Atlanta, Ga., will be enlarged at an estimated expenditure of $150,000 so as to increase the production from 150 to 225 cars per day.

Ruggles Motor Truck Co., London, Ont., has started work on a 50 x 200 ft. extension to its plant. Additional equipment will be required.

Keystone Spring Works, 13th and Buttonwood streets, Philadelphia, has awarded contract for extensions and improvements in its plant.

Buffalo Truck & Tractor Co., Clarence, N. Y., has tentative plans for the erection of a one-story addition to cost $55,000.

Kelsey Wheel Co., Detroit, has filed plans for a one-story addition to cost $25,000.

Production at the Elizabeth plant of Durant Motors has reached 400 units a day. Of these between 250 and 300 are Star cars, the balance being Durant fours.

FOREIGN MANUFACTURING INQUIRIES

The following inquiries, offering manufacturing and merchandising opportunities, have been received recently and are offered to subscribers and friends of Automotive Manufacturer for what they are worth

5085—Machinery for repairing and reinforcing automobile tires—Spain. Purchase. Quotations, f.o.b. New York. Correspondence, Spanish.

5087—Automobile accessories and tools—Denmark. Purchase. Quotations, c.i.f. Danish port. Terms: Cash against documents.

5100—Fire fighting automobile of 70 horsepower, with a pumping capacity of 1,800 liters per minute—Sweden. Purchase. Quotations, c.i.f. Swedish port.

5106—Motor accessories and motor novelties — South Africa. Agency.

5275—Bicycle and motorcycle chains, parts for motorcycles, motors, and other parts in the automobile and motor trade; and a low-priced automobile — Sweden. Purchase and agency. Terms, cash against documents.

5277—Automobile and motorcycle accessories and cutlery —Italy. Agency.

5279—Benzine motors, tractors, and small automobiles— Czechoslovakia. Purchase. Quotations, c.i.f. Hamburg or Adriatic ports. Correspondence, Czech, German, or Magyar.

5283—Automobile accessories — Switzerland. Exclusive agency. Quotations, f.o.b. New York. Terms, payment against documents.

5315—Leather for automobile upholstery—Italy. Agency.

5317—Nonskid automobile chains and spring bolts—Norway. Agency.

5322—Tire setting machine for affixing metal tires on wagon wheels without heating tire—Canada. Purchase. Quotations, f.o.b. port of shipments.

5344—Engineering tools and small machinery, hardware lines, fancy goods, motor and cycle accessories, mecanical goods, and automobile trucks — Australia. Agencies. Quotations, c.i.f. port of New South Wales. Terms, cash against documents.

5353—Automobile tires, tubes, accessories, etc.—Ireland. Purchase.

5363—Electric lamps for home and for motor cars, electric air pumps for automobiles, electric plants for home use, and wireless apparatus—Scotland. Purchase and agency. Quotations, c.i.f. Scottish port.

5378—Pneumatic automobile tires, in millimeter sizes only —England. Purchase. Quotations, f.o.b. New York.

5393—Motorcycles and accessories — Australia. Agency. Quotations, f.o.b. New York.

5400—Automobile tires of the best quality, metric and inch clinchers—Hungary. Agency. Quotations, c.i.f. Hamburg. Terms, cash against documents.

5407—Hardware, tools, automobile accessories, and garage and service-station equipment—South Africa. Agency. Quotations, f.o.b. New York.

5417—Automobiles, trucks, tractors, dairying and farm machinery and implements, machine tools, automobile accessories, small marine motors, and labor-saving devices and machinery—New South Wales, Australia. Agency. Quotations, f.o.b. New York or San Francisco. Terms, cash against documents or confirmed letter of credit.

5422—Electric automobile trucks — France. Purchase. Quotations, c.i.f. French port. Terms, cash. Correspondence and particulars as to cost of operation and technical descriptions desired in French.

5491—Automobiles, motorcycles and bicycles, and their accessories—Rumania. Agency and purchase. Quotations, c.i.f. Rumanian port.

5431—Light motorcycles and automobiles — Austria. Agency. Quotations, f.o.b. New York. Terms, payment against documents.

5460—Materials for the vulcanizing and repairing of worn pneumatic automobile tires and inner tubes—Syria. Purchase. Quotations, c.i.f. Syrian port. Terms, cash in United States currency. Correspondence, French.

5484—Automobile accessories of all kinds, excepting tires; and oils and greases—Belgium. Purchase and agency. Quotations, c.i.f. Belgian port. Terms, cash against documents.

5487—Motorcycles and automotive accessories (novelties) —Austria. Agency. Quotations, f.o.b. New York.

5539—Moderately priced, 4 to 6 cylinder automobiles, and taxicabs—Australia. Agency desired by representative now in the United States.

5546—Marine oil, lubricating oils, and automotive oils, light, heavy, and extra heavy—Spain. Purchase and agency. Quotations, c.i.f. Spanish port.

5564—Imitation leather and bookbinding cloth—Italy. Agency. Quotations, c.i.f. Italian port.

5573—Artificial leather and wire netting—South Africa. Agency. Quotations, f.o.b. New York.

5618—Automobile parts and segments and pistons for motors—Belgium. Purchase and agency. Quotations, c.i.f. Antwerp. Terms: Cash against documents.

5663—Automobiles and motorcycles—Sweden. Purchase. Quotations, c.i.f. Swedish port. Terms: Cash against documents.

5664—Automobile accessories — Switzerland. Purchase and agency. Quotations, c.i.f. Antwerp or Genoa.

5665—Motorcycles of light construction—Austria. Agency. Quotations, f.o.b. New York.

5666—Automobile accessories—Canada. Agency. Quotations, f.o.b. factory.

5667—Passenger automobiles of a small type and automotive accessories—Austria. Agency. Quotations, f.o.b. New York.

5668—Automobile parts and accessories—Austria. Agency.

5669—Automobile accessories, such as lighting systems, electric starters, and furnishings for bodies—Austria. Agency. Quotations f.o.b. New York.

5733—Automobile tires (casings, inner tubes) and accessories—Germany. Agency. Correspondence, German.

5737—Automobile accessories and specialties of every description, suitable for use on small and medium-sized cars—Japan. Purchase. Quotations, c.i.f. Japanese port. Terms: Payment against documents.

5738—Motor vehicles and accessories—Brazil. Agency.

5789—Automobile accessories and supplies—Spain. Purchase and agency. Quotations, f.o.b. New York. Correspondence, Spanish.

5790—Automobiles and accessories—Brazil. Agency.

The foreign inquiries are received mainly through governmental sources, and consequently some delay in reforwarding these must be expected. Answers should comply with the following simple rules: 1, Write one inquiry and only one on each sheet. 2, Give the number set against the inquiry below. 3, Write on your own business letterhead. Address, Commercial Inquiry Dept., Automotive Manufacturer, Heptagon Building, 153 Waverly Place, New York.

MADE TO ORDER

and Delivered on Time

RIVETS Made to order only. .035 to .375 diameter

ESCUTCHEON PINS Carried in stock in Brass and Iron

Made to order in other metals

Send sample or rough sketch for estimate and state quantity wanted. Quantity makes the price

JOHN HASSALL, Inc. Clay and Oakland Sts., Brooklyn New York Established 1850

The Best Bearing Metal on the Market

FAHRIG ANTI FRICTION METAL

A Clean, Homogeneous Tin-Copper Alloy Made by Our Special Formula From New Raw Material for Use as a Babbitt

FAHRIG METAL CO., New York

WILCOX

FINE
FINISHED
FORGED

CARRIAGE HARDWARE AND GEAR IRONS

Write for Prices and Catalog

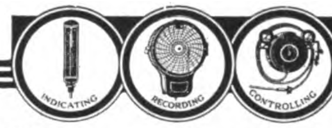
The D. Wilcox Mfg. Co.
MECHANICSBURG, PA.

ECONOMIST-ENGINEER

Constructive Policies—Ways and Means—Diagnosis
Production—Managements—Sales—Exports

W. J. SPENCER M. E., E. E., L. L. D.

Manufacturer & Builders' Exchange
410-416 Bond Building WASHINGTON, D. C.
Pittsburgh — Cleveland — Chicago — Dallas



Tycos temperature instruments

Assure maximum quality by minimizing mistakes where temperature is a factor in your industry. Proved by results where *Tycos* instruments are installed.

Taylor Instrument Companies
Rochester, N.Y. U.S.A.

There's a *Tycos* and *Taylor* temperature instrument for every purpose

---

SUBSCRIBE TO

The AUTOMOTIVE MANUFACTURER

the Best, and at the same time, the Cheapest Journal covering the Automotive Field

Only $2.00 a Year Subscribe Today

Electrical Testing Laboratories

80TH ST. AND EAST END AVE., NEW YORK

Electrical Photometrical and Physical Test

TESTS OF

Head Lamps, Chemical and Metallographic Examinations of Steel and Iron, Lubricating Oils, Gasoline, etc.

PORTER'S BOLT CLIPPERS

"Easy" "New Easy" Allen-Randall

To Cut 5-16, 3-8, 1-2, 5-8, 3-4 Inch.

H. K. PORTER, EVERETT, MASS

KRAKNO

Is the greatest filler or surfacer known to the Auto Painter. You can't afford to operate your Paint shop without it. Price $3.50 per gal. Send for descriptive circular.

The R. F. Johnston Paint Co.
Cincinnati, Ohio

Why Not Have the Best?

One of a Large Variety

C. Cowles & Co.

NEW HAVEN, CONN.

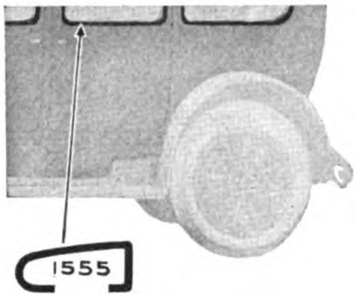
THE CHARLES WING CO.

Established 1848

Manufacturers and Wholesale Dealers in

AUTOMOBILE AND CARRIAGE HARDWARE AND TRIMMINGS

AMESBURY, MASS., U. S. A.



DAHLSTROM
Metal Mouldings & Shapes

COLD DRAWN FINISH MOULDING

Finish moulding has been the name applied to this particular shape because it means all the name implies. It finishes off the window of the closed type car.

Dahlstrom cold drawn garnish or finish moulding is drawn exact to specifications. All preliminary work such as cutting, mitering, bending, drilling, punching and finishing can be done at our plant. We also sell this moulding in straight lengths where purchaser prefers to work it up and finish it.

Durable
Accurate
Hard Smooth Finish
Light Weight
Strong
True to Design
Ready to Apply
Ornamental
Mitered When Desired

Manufactured by
Our trained men
Used by
Leading Manufacturers
Desiring right metal
Shapes

DAHLSTROM METALLIC DOOR COMPANY

419 Buffalo Street, Jamestown, N. Y.

NEW YORK 2 Rector Street
CHICAGO 19 So. LaSalle St.
CLEVELAND: 916 Swetland Bldg.
DETROIT 855 Book Bldg.
ST. LOUIS 106 N. 3rd Street

Representatives In All Principal Cities

MORE THAN 90% OF THE

HARDNESS TESTING

IS NOW DONE BY

The Scleroscope

Universally adopted, direct reading, inexpensive, and the only instrument that agrees with others of its kind in all parts of the world, thus solving problems of ordering materials to specification.

Booklet Free

The Pyroscope

The Pyroscope is the common sense heat measuring instrument that makes straight for results without fuss. Costs least of all, burns simple kerosene, never varies. It is the one invariable trusty in the grimy hands of furnace men, hardeners, carburizers. It is a pet in the laboratory and is also being universally adopted by colleges for demonstration purposes owing to the correctness of the principle utilized.
Our best customers are those who have tried all other means of heat measuring.
Send for interesting bulletin on heat measuring.

THE SHORE INSTRUMENT & MFG. CO.

Van Wyck Ave. and Carll St., JAMAICA, N. Y.

Agents in All Foreign Countries

Pressed Metal Work

Made Specially to Your Order

We can place at your service a 15-acre plant for the manufacture of Gasoline Tanks, Maxim Silencers, Concealed Door Hinges, Pressed Steel Oil Pans, Radiator Shells, Radiator Tanks, Radiator Side Members, Gear Covers, Cylinder Covers and other Pressed Metal Parts.

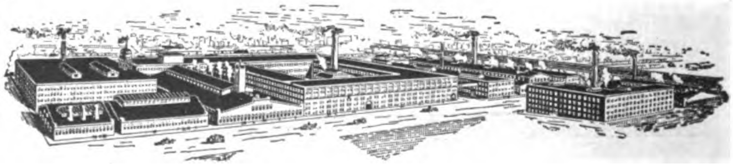
It will pay you to give us a chance to quote.

G.P.&F. SERVICE
"KNOWING HOW SINCE '81"

Geuder, Paeschke & Frey Co.

1200-1600 St. Paul Ave., Milwaukee, Wis.

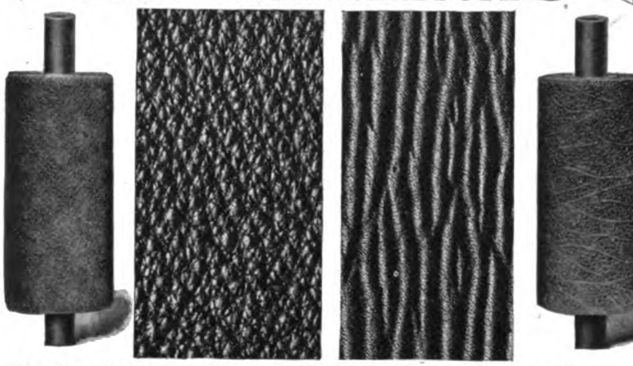
Exclusive manufacturers of the Maxim Silencer



ESTABLISHED 1871

F. A. RINGLER COMPANY

NEW YORK
21-23 BARCLAY ST. TO 26-28 PARK PLACE



EMBOSSING AND GRAINING PLATES AND ROLLS

BY THE MOST PERFECT METHODS

We have upwards of 300 patterns of natural and mechanical grains for embossing and graining real and artificial leather and are in a position, by our large Engraving and Electrotyping Plant, to make any grain or design you may be in need of.

For further particulars please apply to

Very truly yours,

F. A. RINGLER CO.,
New York City.

CHATILLON SCALES

For Many Particular Purposes ordinary scales are entirely inadequate.

CHATILLON SPECIAL SCALES

will help you improve the efficiency of your organization. Write us in detail, explaining the conditions and the materials to be weighed. Our experts will study the problem, and design a scale that will most satisfactorily perform the operation.

Many manufacturers are obtaining gratifying results from Chatillon Special Scales. Submit your data without obligation

JOHN CHATILLON & SONS
New York U.S.A.

OUR LONG EXPERIENCE ENABLES US TO FURNISH RELIABLE SERVICE TO ANYONE DESIRING SMALL OR MEDIUM-SIZED

DROP FORGINGS

of QUALITY and ACCURACY

Send Us Your Blue Prints for Quotations
Ask for Our Latest Catalog of Vehicle Hardware

RICHARD ECCLES CO., AUBURN, N. Y
(Established in 1880)

The C. H. A. T. Inc.

Organized November 18, 1891
Incorporated October 7, 1902

The Carriage, Harness and Accessory Traveling Salesmen's Association, Inc., of the United States

Promotes the business, social and moral welfare of its members. Helps to secure situations. Salesmen in the Carriage, Harness or Accessory lines only eligible. Further information cheerfully given by addressing

P. D. RANDALL, Sec'y and Treas.
231 Union street SPRINGFIELD, MASS.